

Information-Based Processing of Korean Dialogue with Reference to English

Dong-Young Lee

**PhD
The University of Edinburgh
1998**



Declaration

I declare that this thesis has been composed by myself and that the research reported in it is my own.

Dong-Young Lee

January 1998

Abstract

This thesis shows that making use of contextual information coming from an utterance and keeping track of information flow between utterances in dialogue are indispensable to the processing of dialogue. In English, the phenomenon of honorification does not occur, honorific pronouns do not exist, and pronouns are used instead of omitting a whole constituent. On the other hand, in Korean dialogue, every utterance indicates whether or not honorification occurs. In addition, an honorific pronoun may be used and a constituent such as the subject NP or the object NP is omitted when it can be recovered by context. We claim that in order to process Korean dialogue properly, we must systematically use contextual information such as social status information about all the individuals involved in dialogue and information about dialogue participants (that is, the speaker and the addressee of utterances).

It is possible to incorporate contextual information within the framework of Head-Driven Phrase Structure Grammar (HPSG) and thus we use that framework to deal with utterances occurring in dialogue. We construct the representation structure of dialogue by extending and modifying Discourse Representation Theory (DRT) and contextual information is included in the representation structure. We show that the occurrence of honorification is constrained by the relative order of the social status of the speaker, the addressee and the individuals mentioned in an utterance. We also show how to recover missing constituents in an utterance, using both structural information and contextual information related to the utterance. When an honorific pronoun is used in a dialogue, we resolve it based on the information about social status obtained from the dialogue.

We implement dialogue processing using Prolog. The utterances of a dialogue are processed by utilizing the Attribute Logic Engine (ALE) and an HPSG grammar for Korean. After each utterance is processed, the representation structure of the utterance is constructed on the basis of the information extracted from the processing result. The tasks of resolving honorific pronouns, recovering missing constituents, and checking whether honorification occurs correctly are carried out by consulting the information contained in the representation structures of utterances. When all utterances of a dialogue have been processed, the representation structure of the dialogue, which is composed of the representation structures of utterances, is obtained along with the order of the social status of the individuals involved. If an honorific pronoun cannot be resolved, a missing constituent cannot be recovered, or incompatibility arises in social status information, the dialogue is judged to be incoherent and thus its representation structure is not obtained. In this case the source of incoherence is suggested instead. Therefore, the implemented model successfully deals with linguistic phenomena that occur in dialogue and produces a structure representing dialogue only when it is coherent.

Acknowledgements

First of all, I owe a great debt to my supervisors, Matt Crocker and Lex Holt. Their patience, criticism, and encouragement have enabled me to carry out and complete this work. Special thanks go to Matt for his support and guidance through my study at the Centre for Cognitive Science. I am also grateful to my examiners, Steve Harlow and Colin Matheson, for their comments and suggestions.

I would like to thank Elisabet Engdahl for her help at the early stage of my study. This work has benefited from discussions with Chris Brew, Jo Calder, Claire Grover, and Massimo Poesio. I would also like to thank Choon-Hak Cho, In-Sook Kim, Myong-Yol Kim, and Nahm-Sheik Park for having made me feel that Seoul is not far away from Edinburgh.

For generous financial support, I am greatly indebted to Owoon Cultural Foundation. It has also made me keep abreast with rapidly changing Korean society during my stay here in Edinburgh.

My deep gratitude goes to my parents. Their support and advice have helped me overcome various kinds of difficulties. I am also grateful to my parents-in-law for delicious and nutritious food.

Finally, I would like to thank my beloved wife and son, for their support, love, understanding, and endurance.

Contents

1	Introduction	1
1.1	Information Flow in Dialogue	2
1.2	A Brief Look at Korean Syntax	2
1.3	Differences between Korean Dialogue and English Dialogue	4
1.3.1	Honorification	5
1.3.2	An Honorific Pronoun	7
1.3.3	Missing Constituents	8
1.4	Processing of Dialogue	10
1.5	Summary	11
1.6	Organization of the Thesis	12
2	The Honorification System in Korean	14
2.1	Honorific Morphemes	15
2.2	Honorification Types	17
2.2.1	Subject Honorification	17
2.2.2	Object Honorification	18
2.2.3	Addressee Honorification	20
2.2.4	Multiple Honorification	20
2.3	Previous Analyses of Honorification and A New Analysis	21
2.3.1	Previous Analyses	22
2.3.2	Extracting Information about Social Status	25
2.3.3	A New Analysis and Its Advantages	28
2.4	Effects of Honorification	33
2.4.1	Felicity of Utterance	34
2.4.2	Coherence of Dialogue	35
2.5	Summary and Discussion	36
3	An Information-Based Approach: Head-Driven Phrase Structure Grammar	38
3.1	A Sign System	39
3.2	Advantages of the Framework: Incorporation of Contextual Information	43
3.2.1	Dialogue Participants	43

3.2.2	The Honouring Relation	44
3.2.3	Relative Order of Social Status	46
3.3	Obtaining Contextual Information from An Utterance	48
3.4	Summary	52
4	Dialogue Representation	54
4.1	Discourse Representation Theory	54
4.1.1	Framework	55
4.1.2	Limitations	57
4.2	Dialogue Representation Theory	60
4.2.1	Extension of Discourse Representation Theory	60
4.2.2	Representation of Information Flow among Utterances	62
4.2.3	Dialogue Representation Structure	64
4.3	Detection of Incoherent Dialogue	68
4.4	Summary	69
5	The Resolution of Honorific Pronouns	71
5.1	Characteristics of an Honorific Pronoun	71
5.2	Resolving an Honorific Pronoun Based on Social Status Information	74
5.3	Summary and Discussion	81
6	The Recovery of Missing Constituents	83
6.1	Types of Omission and Recovery	83
6.2	Real Spoken Dialogue	92
6.3	Centering Theory	94
6.3.1	Framework	95
6.3.2	Inadequacy to the Recovery of Constituents	98
6.4	Pragmatic Approach	100
6.4.1	Recovering Algorithm	101
6.4.2	Application to Real Spoken Dialogue	104
6.5	Summary and Discussion	106
7	Implementation	108
7.1	Dialogue Manager	109
7.2	Parsing	116

7.2.1	Overview of ALE	116
7.2.2	Lexical Entries	119
7.2.3	Lexical Rules	122
7.2.4	Grammar Rules	124
7.2.5	Output of Utterance Parsing	129
7.3	Extracting Information Relevant to Dialogue Representation	134
7.4	Recovering Missing Constituents and Checking Compatibility	140
7.5	Resolving an Honorific Pronoun	151
7.6	Constructing the Dialogue Representation Structure	155
7.7	Computing Social Status Information	158
7.8	Summary	161
8	Directions for Future Research	163
8.1	Treatment of Honorification Spreading	163
8.2	Recovery of Missing Constituents in Complex Utterances	165
8.3	Overcoming Undergeneration	166
8.4	Application to Generation of Korean Dialogue	168
8.5	Summary and Discussion	169
9	Conclusions	171
	References	174
A	Transcripts of Real Spoken Dialogues	178
B	Sample Runs of Dialogue Processing	189

Chapter 1

Introduction

While discourse is related to the viewpoint of a single person, dialogue takes place between more than one individual. In dialogue the speaker and the addressee may vary from utterance to utterance. This means that multiple viewpoints are expressed in dialogue. Various kinds of information can be obtained from dialogue. Although syntactic and semantic information is directly obtainable from utterances occurring in dialogue, contextual information about individuals participating in dialogue can be obtained at the dialogue level. Interactions may occur between these pieces of information. In order for an utterance of a dialogue to be felicitous, there must be no conflict in some crucial information coming from the utterance. In addition, in order for a dialogue to be coherent, conflict must not arise between crucial information provided by each utterance of the dialogue. Thus to process dialogue appropriately, we have to utilize relevant information.

In Korean, social status information about individuals involved in a dialogue plays an important role in determining the felicity of an utterance and coherence of a dialogue. This crucial information can be extracted from some specific morphemes used in utterances of dialogue. In Korean dialogue, the phenomenon of honorification occurs, honorific pronouns may appear, and whole constituents can be omitted if they are recoverable from the context. In dealing with these linguistic phenomena, information about social status is also essential. Thus when processing Korean dialogue, we make systematic use of contextual information such as information about the speaker and the addressee of each utterance of a dialogue and information about the social status of all individuals involved in a dialogue as well as syntactic and semantic information. Moreover, we make information obtained from an utterance of a dialogue available to subsequent utterances so that information flow among utterances may be captured.

1.1 Information Flow in Dialogue

A dialogue consists of utterances. In order for a dialogue to be coherent, there must be compatibility in the pieces of crucial information provided by the utterances occurring in the dialogue. In other words, only when incompatibility does not exist in the information provided by each utterance and incompatibility does not arise in the collection of the pieces of the information obtained from all utterances of a dialogue, the dialogue is coherent. For example, if the social status information provided by an utterance is not compatible with the social status information provided by its preceding utterances, the dialogue containing those utterances is not coherent. Thus crucial information flows from utterance to utterance in a dialogue.

The flow of information in a dialogue is captured by making the information provided by an utterance available to its subsequent utterances. By means of this mechanism we can check whether the information provided by an utterance is compatible with the information provided by its preceding utterances. As soon as incompatibility is found, a dialogue is judged to be incoherent. Thus to detect incoherence of a dialogue, we do not always need to process all utterances of the dialogue. On the other hand, we can find out the coherence of a dialogue only after all utterances occurring in the dialogue are processed.

By using information flow among utterances that occur in a dialogue, it is possible to resolve a pronoun and to recover omitted constituents in the dialogue, as well as to check whether an utterance is felicitous and the dialogue is coherent. Thus making use of information flow in a dialogue is indispensable to the processing of the dialogue.

1.2 A Brief Look at Korean Syntax

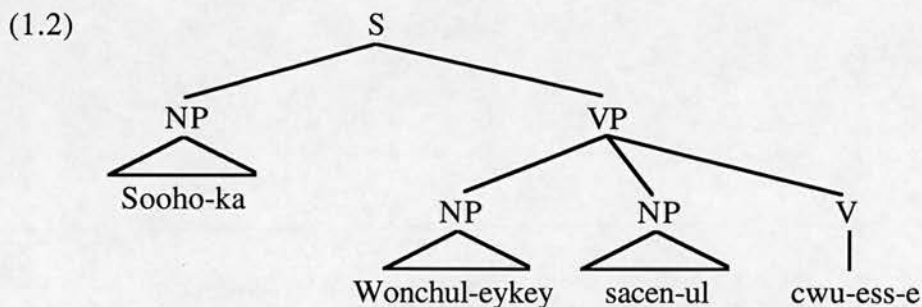
An utterance occurring in a dialogue usually takes the form of a sentence. Thus let us consider the characteristics of Korean sentences in comparison with English sentences.

While English is a head-initial language, Korean is a head-final language. In other words, the head occurs initially in the VP of English, whereas it occurs finally in the VP of Korean. As an example, let us look at the sentence shown in (1.1).

- (1.1) Sooho-ka Wonchul-eykey sacen-ul cwu-ess-e.
nom dat dictionary-acc give-past-dec

‘Sooho gave a dictionary to Wonchul.’

The tree structure for sentence (1.1) is as illustrated in (1.2).



The head of a VP is a verb and it occurs after other constituents, as shown in (1.2). A case marker that attaches to an NP indicates whether that NP is a nominative NP, a genitive NP, a dative NP, or an accusative NP. Thanks to case markers, even if the canonical order of NPs (that is, in the order of a nominative NP, a dative NP, and an accusative NP) changes in a sentence, it is possible to catch the meaning of the sentence. The verb of a sentence, however, cannot be moved to a position other than the final position of the sentence. Consequently, the verb of a sentence must occur after all other constituents of the sentence.

In English a complementizer is indicated by a separate word (namely, *that*, *if*, or *whether*), whereas in Korean it is incorporated in the verb of an embedded clause. As an example, let us consider a sentence that has an embedded clause as well as a main clause.

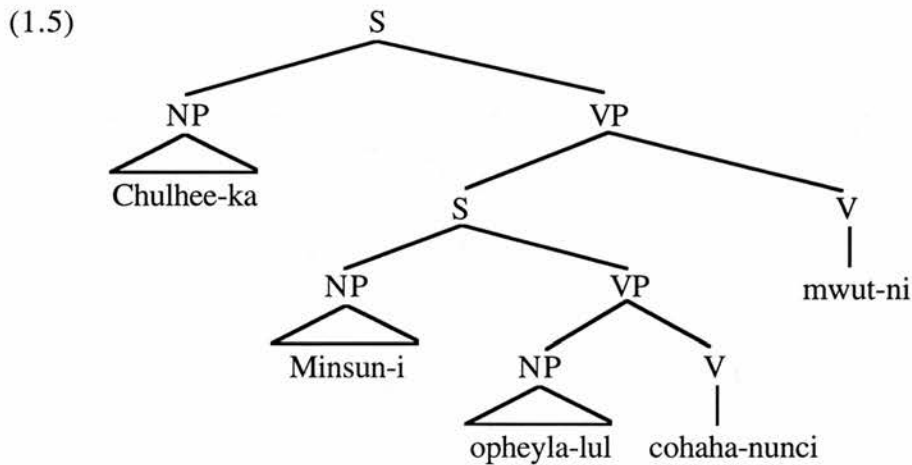
- (1.3) Chulhee-ka Minsun-i opheyla-lul cohaha-nunci mwut-ni?
 nom nom opera-acc like-comp ask-int
 ‘Does Chulhee ask whether Minsun likes operas?’

As shown in (1.3), the complementizer *nunci* is not an independent word, but a morpheme that must be incorporated in a verb. The verb that contains a complementizer cannot be the predicate of the main clause. The verbal ending, which indicates whether a sentence is a declarative one or an interrogative one, can appear only in the main verb. Thus a verb containing a complementizer can occur only in an embedded clause of a sentence, whereas a verb containing a verbal ending can occur only in a main clause. The phrase structure rules for dealing with a sentence where an

embedded clause occurs are as shown in (1.4).

- (1.4)
- a. $S \rightarrow NP, VP$
 - b. $VP \rightarrow S, V$
 - c. $VP \rightarrow V$
 - d. $VP \rightarrow NP, V$
 - e. $VP \rightarrow NP, NP, V$

Because of the two rules (1.4a) and (1.4b), recursion occurs and thus any number of embedded clauses can be treated.¹ The structure of the sentence shown in (1.3) is as illustrated in (1.5), on the basis of the rules in (1.4).



While the main clause is represented by the topmost S node, the embedded clause is represented by the S node which is dominated by a VP node. From the structure shown in (1.5) we can infer that the main predicate of a sentence occurs after all other predicates occurring in embedded clauses.

1.3 Differences between Korean Dialogue and English Dialogue

In addition to the structural differences in a sentence between English and Korean,

¹In the case of English, which is a head-initial language and has a word for a complementizer, the rule in (1.4b) must be changed to $VP \rightarrow V, S'$ and $S' \rightarrow \text{Comp}, S$. In addition, the rules in (1.4d) and (1.4e) have to be changed to $VP \rightarrow V, NP$ and $VP \rightarrow V, NP, NP$, respectively.

there are also differences in the linguistic phenomena that occur in a dialogue. Let us consider those phenomena one by one.

1.3.1 Honorification

Honorification occurs when the speaker of an utterance shows honour to the addressee or to the person who is mentioned in the utterance. The occurrence of honorification is constrained by the relative social status of the people involved in an utterance. Honorification is linguistically realized in an utterance through honorific morphemes. Thus, depending on the social status of the people involved in an utterance, the form of the utterance varies. As an example, let us look at the utterance shown in (1.6).

- (1.6) Y-ka tungsan-ul culki-ni?
 nom mountaineering-acc enjoy-int
 'Does Y enjoy mountaineering?'
 (Speaker: K, Addressee: P)

Three individuals (that is, *Y*, *K*, and *P*) are involved in utterance (1.6). Since no honorification occurs in the utterance, that utterance can be used when the social status of the speaker is equal to or higher than that of the other two individuals. When the social status of *Y* is higher than that of the speaker and the addressee, the utterance shown in (1.7) must be used, instead of utterance (1.6).

- (1.7) Y-kkeyse tungsan-ul culki-si-ni?
 nom (hon) mountaineering-acc enjoy-hon-int
 'Does Y enjoy mountaineering?'
 (Speaker: K, Addressee: P)

In utterance (1.7) the honorific nominative case marker *kkeyse* and the honorific infix *si* are used to show honour to the referent of the subject NP. Furthermore, in the case where the social status of the addressee is higher than that of the speaker and the social status of *Y* is higher than that of the addressee, neither utterance (1.6) nor utterance (1.7) can be used. Instead the utterance shown in (1.8) must be used.

- (1.8) Y-kkeyse tungsan-ul culki-si-eyo?
 nom (hon) mountaineering-acc enjoy-hon-int (hon)
 'Does Y enjoy mountaineering?'
 (Speaker: K, Addressee: P)

The difference between utterance (1.7) and utterance (1.8) is that in the former utterance the nonhonorific interrogative verbal ending *ni* is used, whereas in the latter utterance the honorific interrogative verbal ending *eyo* is used. By using the honorific verbal ending, the speaker of utterance (1.8) shows honour to the addressee. On the other hand, in English the phenomenon of honorification does not exist. Thus the form of an utterance does not change according to the order of the social status of the individuals involved in the utterance.

In a dialogue the form of each utterance reflects the social status of the individuals involved in the dialogue. As an example, let us look at the dialogue shown in (1.9).

- (1.9) a. W-ka H-kkey selyu-lul pwuchi-ess-supnita.
 nom dat (hon) document-acc mail-past-dec (hon)
 'W mailed a document to H.'
 (Speaker: M, Addressee: S)
- b. W-ka selyu-lul caksengha-yess-ni?
 nom document-acc write out-past-int
 'Did W write out the document?'
 (Speaker: S, Addressee: M)

In dialogue (1.9) four individuals (namely, *W*, *H*, *M*, and *S*) are involved. The speaker of utterance (1.9a) shows honour to the referent of the dative object NP and the addressee. In utterance (1.9b) neither the referent of the subject NP nor the addressee is honoured by the speaker of that utterance. The occurrence of honorification in dialogue (1.9) is correct when the order of the social status of the four individuals involved in the dialogue is as shown in (1.10).

- (1.10) $H > S > M > W$

On the other hand, in the case where the order of social status illustrated in (1.11)

holds true, the form of a dialogue held under such a situation should be different from that of dialogue (1.9).

(1.11) W>H>S>M

In this case the form of dialogue (1.9) must be changed to the one shown in (1.12).

(1.12) a. W-kkeyse H-kkey selyu-lul pwuchi-si-ess-supnita.
 nom (hon) dat (hon) document-acc mail-hon-past-dec (hon)
 ‘W mailed a document to H.’
 (Speaker: M, Addressee: S)

b. W-kkeyse selyu-lul caksengha-si-ess-ni?
 nom (hon) document-acc write out-hon-past-int
 ‘Did W write out the document?’
 (Speaker: S, Addressee: M)

Since the social status of the speaker of utterance (1.12a) is lower than that of the other three individuals, he shows honour to all of them in that utterance. In utterance (1.12b) the speaker does not show honour to the addressee because the social status of the former is higher than that of the latter. Thus the form of a dialogue changes depending on the order of the social status of the people involved in the dialogue and this order is indicated through the honorification phenomenon occurring in the dialogue.

1.3.2 An Honorific Pronoun

Due to the honorification phenomenon, an honorific pronoun exists in Korean. Just as honorification is related to a person, so the honorific pronoun refers to a person. There is only a third-person honorific pronoun. This means that the honorific pronoun cannot refer to the speaker or the addressee of the utterance where it occurs. As an example, let us look at the dialogue shown in (1.13).

(1.13) a. M-i R-kkey chengsacin-ul tuli-ess-e.
 nom dat (hon) blueprint-acc give-past-dec

‘M gave a blueprint to R.’

(Speaker: L, Addressee: J)

- b. kupwun-kkeyse kongsa-lul kamtokha-si-eyo?
 he/she (hon)-nom (hon) construction-acc superintend-hon-int (hon)
 ‘Does he/she superintend a construction work?’
 (Speaker: J, Addressee: L)

In utterance (1.13b) the honorific pronoun *kupwun* occurs. The social status of the pronoun’s referent must be higher than that of the speaker of the utterance (that is, the person *J*). From utterance (1.13a) it can be determined that the social status of *R* is higher than that of *J*. Thus the honorific pronoun in utterance (1.13b) resolves to the person *R* who is mentioned in its preceding utterance. Since gender information is not provided by the honorific pronoun, such information does not assist in the resolution of the pronoun.

1.3.3 Missing Constituents

In Korean, constituents such as the subject NP and the object NP are frequently omitted when they can be recovered from the context of a dialogue. Since a verbal inflection does not occur, we cannot recover a missing constituent by means of the form of a verb. Thus the recovery of missing constituents depends on the context in which they are missing. As an example, let us consider the dialogue shown in (1.14).

- (1.14) a. e cinan cwumal-ey yenkuk-ul po-ass-ni?
 last weekend-postp play-acc watch-past-int
 ‘Did you watch a play last weekend?’²
 (Speaker: P, Addressee: S)

- b. Younsoo-ka e po-ass-e.
 nom watch-past-dec
 ‘Younsoo watched it.’
 (Speaker: S, Addressee: P)

²We use the symbol ‘e’ to show that a constituent is omitted. In English glosses the word corresponding to a missing constituent is formatted in the same typeface as the symbol.

- c. Youngsoo-ya, yenkuk-i caymiiss-ess-ni?
 voc play-nom interesting-past-int

‘Youngsoo, was the play interesting?’

(Speaker: P, Addressee: Youngsoo)

- d. e hwullyungha-yess-e.
 wonderful-past-dec

‘It was wonderful.’

(Speaker: Youngsoo, Addressee: P)

Utterance (1.14a) occurs initially in the dialogue and takes the form of an interrogative utterance. Thus the subject NP which is missing in the utterance refers to the addressee of that utterance. In utterance (1.14b) the object NP is omitted. Since the verb of utterance (1.14b) is the same as that of its immediately preceding utterance (i.e., utterance (1.14a)), the missing object NP of utterance (1.14b) refers to the object NP of utterance (1.14a). In utterance (1.14c) a vocative NP occurs and thus the addressee is the referent of that NP. In utterance (1.14d) no vocative NP occurs and the predicate of the utterance is different from that of its immediately preceding utterance (namely, utterance (1.14c)). Thus the missing NP of utterance (1.14d) refers to the subject NP of utterance (1.14c). On the other hand, in English dialogue, a pronoun is used rather than a whole constituent is omitted. For example, the dialogue shown in (1.15) is not allowed in English.

- (1.15) a. e watched a play on last weekend?
 (Speaker: Percy, Addressee: Stephen)

- b. Emily watched e.
 (Speaker: Stephen, Addressee: Percy)

- c. Emily, was the play interesting?
 (Speaker: Percy, Addressee: Emily)

- d. e was wonderful.
 (Speaker: Emily, Addressee: Percy)

In order for the dialogue in (1.15) to be accepted as a normal English dialogue, a pronoun must be used in the place where a constituent is omitted.

1.4 Processing of Dialogue

Since dialogue is composed of utterances, we should first deal with them to process dialogue. In an utterance of a dialogue the phenomenon of honorification may occur, an honorific pronoun may appear, and constituents can be omitted.³ From the honorification phenomenon occurring in an utterance we obtain the information about the social status of the individuals involved in the utterance. When honorification does not occur properly in an utterance, incompatibility arises in social status information. In this case we judge the utterance to be infelicitous. We resolve an honorific pronoun appearing in an utterance based on social status information. We also recover constituents that are missing in an utterance using structural and contextual information obtained from the utterance itself and from its preceding utterances.

After an utterance of a dialogue is processed, we construct the representation structure of the utterance. In the representation structure of an utterance the information about the speaker and the addressee of the utterance and the social status information obtained from the utterance are included. In addition, by using the structure that contains information obtained from an utterance as a dialogue referent, we make information flow from an utterance to its subsequent utterances. Thus when an utterance is processed, we can use information obtained from its previous utterances. As each utterance occurring in a dialogue is processed, we construct the interim representation structure of the dialogue based on the representation structures of the utterances that are already processed. When all utterances of a dialogue have been processed and the dialogue is found to be coherent, we get its final representation structure. If incompatibility exists in the information obtained from a dialogue, an honorific pronoun cannot be resolved, or a missing constituent cannot be recovered, we judge that the dialogue is incoherent and thus the representation structure of the dialogue is not obtained. Therefore, we process dialogue in a compositional and incremental way by processing utterances of dialogue one by one based on all relevant

³In this thesis we are not concerned with inferring intentions, goals, or plans of dialogue participants from utterances of dialogue. For the treatment of those aspects, consult the following works: Carberry 1990, Grosz and Sidner 1986, Grosz and Sidner 1990, Litman and Allen 1990, and Pollack 1986.

information and flow of information among utterances.

On the basis of a corpus of human map task dialogues, in which the task of navigating routes on maps is involved, Carletta (1992) claims that human agents try to complete tasks with as little effort as possible and thus they often decide to take risks. She argues that as a result of risk-taking they run into plan failures and then use strategies for recovering from these failures. Thus she focuses her attention on several aspects of the behaviors of human agents participating in task-oriented dialogues, not on linguistic phenomena occurring in such dialogues.

On the other hand, Grosz and Sidner (1990) are interested in inferring intentions and plans of dialogue participants from utterances of dialogue. They think that each utterance of dialogue provides partial information about the intentions and beliefs of the speaker. Thus they focus their attention on keeping track of mental states of dialogue participants on the basis of utterances of dialogue. This means that they are not interested in linguistic phenomena occurring in dialogue, either.

Our approach to dialogue processing is different from those approaches adopted in the two works discussed above in that we concentrate our attention on dealing with linguistic phenomena occurring in dialogue and checking the coherence of dialogue based on morphological, syntactic, semantic, and contextual information.

1.5 Summary

Although a dialogue consists of utterances, it is not merely a sequential collection of utterances. If the information obtained from an utterance is not compatible with the information obtained from its preceding utterances, the dialogue containing those utterances is incoherent. The processing of a dialogue is based on the processing of the utterances occurring in the dialogue. When a non-initial utterance of a dialogue is processed, the information obtained from its preceding utterances must be available to deal with the linguistic phenomena that occurs in the utterance. Thus making information flow appropriately from utterance to utterance is necessary for processing a dialogue.

In contrast to English dialogue, the following phenomena occur in Korean dialogue: honorification phenomenon occurs, honorific pronouns may appear, and whole constituents are omitted when recoverable from context. To treat these phenomena, information about dialogue participants (that is, the speaker and the addressee of each utterance of a dialogue) and information about the order of the social

status of the individuals involved in a dialogue must be used. This means that we have to make appropriate use of contextual information to process a dialogue properly.

In this thesis we investigate the processing of naturally occurring Korean dialogue, using all pieces of relevant information (namely, morphological, syntactic, semantic, and contextual information). Since contextual information such as information about dialogue participants and social status information plays a crucial role in dealing with linguistic phenomena occurring in Korean dialogue, we keep track of that information throughout dialogue. We also utilize such crucial information in determining whether an utterance is felicitous and whether a dialogue is coherent. When a dialogue is found to be coherent, we obtain the representation structure of the dialogue. On the other hand, when a dialogue is incoherent, we trace the source of the incoherence on the basis of contextual information. Thus we propose that the systematic use of contextual information related to dialogue is essential to the appropriate processing of dialogue.

1.6 Organization of the Thesis

In the next chapter we discuss the system of honorification and present our new analysis that makes use of social status information. Since dialogue takes place between people and honorification is related to people, the phenomenon is intrinsic to processing dialogue. In chapter 3 we look at the framework of Head-Driven Phrase Structure Grammar. This framework enables us to formalize the contextual information, including information about the speaker and the addressee of an utterance and information about the social status of the people involved in an utterance and thus we adopt the framework in parsing utterances of dialogue. The framework is used to represent information obtained from utterances, and the *evaluation* of information is not carried out within that framework. It is carried out by the dialogue manager that is explained in chapter 7. In chapter 4 we outline the limitations that arise when we try to apply Discourse Representation Theory to dialogue and then present our Dialogue Representation Theory to cope with the phenomena that occur in dialogue and to process dialogue more appropriately. In chapter 5 the properties of an honorific pronoun and its resolution based on the information about the relative order of the social status of the individuals involved in dialogue are discussed. In chapter 6 we describe the situations where a constituent is omitted and the characteristics of real spoken dialogue. After showing that centering theory, which is used to interpret anaphora in discourse, cannot be directly applied to the recovery of missing

constituents in dialogue, we present our pragmatic approach that uses both structural information and contextual information and illustrate the effectiveness of the approach in recovering missing constituents in real spoken dialogue. In chapter 7 we discuss the implementation of the dialogue processing system. The processing of dialogue utterances using the Attribute Logic Engine, the use of information flow among utterances, the treatment of linguistic phenomena that occur in dialogue, the construction of dialogue representation structure, and the computation of the order of social status for the individuals involved in dialogue are accounted for. In chapter 8 we suggest the direction of future work that would extend what is achieved in the thesis. The final chapter gives a summary of the thesis and its contribution to dialogue processing.

Chapter 2

The Honorification System in Korean

Honorification is a pervasive linguistic phenomenon in Korean, which indicates who is honoured by the speaker of an utterance. The individuals who may be honoured by the speaker are a subject referent, an object referent (if available), and the addressee. Since it is a virtue in Korean society for an individual to humble oneself, the speaker cannot honour himself or herself. The speaker shows whether he or she honours a certain person involved in an utterance by using specific honorific morphemes. Thus the phenomenon of honorification is concerned with people.¹ In everyday life dialogue is held between people. This means that honorification is an essential phenomenon that occurs in dialogue. The system of honorification consists of three types of honorification: subject honorification (the subject referent is honoured), object honorification (the object referent is honoured), and addressee honorification (the addressee is honoured). On the basis of honorific morphemes used in an utterance, we can recognize what type of honorification occurs in that utterance. Although honorification is linguistically realized through the use of specific honorific morphemes, its occurrence in an utterance or a dialogue is constrained by an extra-linguistic factor: the relative order of the social status of people involved in that utterance or in that dialogue. Such elements as seniority, social rank, and kinship play a role in deciding social status. Since we deal with linguistic expressions, we need not know the actual social status of each individual involved in dialogue. What we are interested in is retrieving information about the relative order of the social status of people involved in dialogue based on the type of honorification occurring in dialogue, for the purposes of checking coherence of dialogue and accounting for other linguistic phenomena related to dialogue.

In this chapter we first look at various honorific morphemes and then types of

¹In the special case where a subject referent does not refer to a person, but refers to an inalienable part of the person who is honoured by the speaker, an honorific infix appears in the verb corresponding to the subject NP (for details about this special case, see Lee 1996a). Even in this case, however, no honorific morpheme can attach to the subject NP whose referent is not a person. It follows from this that honorific morphemes can attach to an NP that refers only to a person.

honorification that may occur in an utterance. In the following section limitations of previous analyses of honorification and advantages of a new analysis, which makes use of social status information, are presented. How honorification has an effect on the felicity of utterance and coherence of dialogue is explained in the subsequent section. The final section concludes that the use of social status information is important in the processing of dialogue.

2.1 Honorific Morphemes

Whether or not honorification occurs in an utterance is indicated by specific morphemes such as an honorific suffix, honorific case markers, an honorific infix, honorific verbal endings, and humble verb forms. Let us take a closer look at them one by one.

First, when the honorific suffix *nim* attaches to an NP occurring in an utterance, the person who is referred to by the NP is honoured by the speaker of the utterance (for example, *K-nim*).

Second, when an honorific case marker is used in an utterance, the referent of the NP to which the honorific case marker attaches is honoured by the speaker of the utterance (for instance, *K-kkeyse* and *K-kkey*). Nonhonorific (that is, plain) case markers and honorific case markers corresponding to them are as shown in (2.1).

(2.1) Case Markers

	nominative	topic	genitive	dative	accusative
plain	ka, i	un, nun	uy	eykey	ul, lul
honorific	kkeyse	-	-	kkey	-

Since an honorific counterpart does not exist for the topic case, genitive case, or accusative case, the referent of a topic NP, genitive NP or accusative NP is honoured when a topic NP, genitive NP or accusative NP contains the honorific suffix *nim*, respectively (for example, *K-nim-un*, *K-nim-uy*, and *K-nim-ul*). It is also possible to attach both the honorific suffix *nim* and an honorific case marker to an NP as in *K-nim-kkeyse* and *K-nim-kkey*. The nominative NPs such as *K-nim-i*, *K-kkeyse*, and *K-nim-kkeyse*, and the dative NPs such as *K-nim-eykey*, *K-kkey*, and *K-nim-kkey* all provide the same information that the referent of *K* is honoured by speaker.

Third, when the honorific infix *si* appears in a verb in an utterance, the referent of the subject of that verb is honoured by the speaker of the utterance.

Fourth, when an honorific verbal ending is used in an utterance, the speaker of the utterance shows honour or courtesy to the addressee of the utterance. If the social status of the speaker is higher than that of the addressee and an honorific verbal ending is used, the speaker shows *courtesy* to the addressee. For example, when a president of a company talks to the gatekeeper of the company, the former may use an honorific verbal ending. In this case the social status of the former is higher than that of the latter and thus we cannot say that the former honours the latter, but we can say that the former shows courtesy to the latter. On the other hand, if the social status of the addressee is higher than that of the speaker and an honorific verbal ending is used, the speaker shows *honour* naturally and duly to the addressee. Thus just by an honorific verbal ending used in an utterance we cannot tell whether it is used for showing honour or for showing courtesy. The nonhonorific (i.e., plain) verbal endings and honorific verbal endings corresponding to them are as illustrated in (2.2).

(2.2) a. Declarative Verbal Ending²

	formal	informal
plain	ta	e, a
honorific	(su)pnita	((y)e)yo

b. Interrogative Verbal Ending

	formal	informal
plain	(nu)nka	ni, e, a
honorific	(su)pnikka	((y)e)yo

²The notation ‘((y)e)yo’ means that it can be realized as *yo*, *eyo*, or *yeyo* (the realization form depends on the phonological property of the preceding sound(s)). For example, the verbal ending *eyo* is realized when its preceding sound is a consonant or the vowel *i*. This applies to the notation used in other verbal endings.

c. Imperative Verbal Ending

	formal	informal
plain	(e)la	e, a
honorific	sipsio	(u)seyyo

d. Propositive Verbal Ending³

	formal	informal
plain	ca	e, a
honorific	sipsita	siciyo

The relationship between the speaker and the addressee of an utterance determines whether a formal verbal ending or an informal verbal ending can be used. For example, when a conversation is held between friends, an informal verbal ending is used. On the other hand, when a businessman talks to another businessman, a formal verbal ending is used.

Finally, when a humble verb form is used in an utterance, the referent of an object NP (namely, a direct object NP or an indirect object NP) is honoured by the speaker. For example, the verb *tuli* is a humble verb form of the verb *cwu* ‘give’.

2.2 Honorification Types

Depending on who is honoured by the speaker of an utterance, the honorification type (that is, subject honorification, object honorification, addressee honorification, or multiple honorification) is determined. The individual who is honoured by the speaker may be a subject referent, an object referent, the addressee, or any combination of these three people.

2.2.1 Subject Honorification

When a subject referent is honoured by the speaker of an utterance, subject honorification occurs.

³This verbal ending is used when the speaker suggests some action to be taken to the addressee.

- (2.3) S-kkeyse kay-lul khiwu-si-e.
 nom (hon) dog-acc keep-hon-dec
 ‘S keeps a dog.’
 (Speaker: L, Addressee: H)

In (2.3) the honorific nominative case marker *kkeyse* attaches to the subject NP *S* and the honorific infix *si* appears in the verb. The linguistic constraint on the occurrence of subject honorification is that the conditions in (2.4) must be satisfied.

- (2.4) a. The honorific nominative case marker *kkeyse* or the honorific suffix *nim* should attach to the subject NP.
- b. The honorific infix *si* should appear in the verb corresponding to the subject NP that contains an honorific morpheme.

When subject honorification occurs, the social status of a subject referent is higher than that of the speaker and is equal to or higher than that of the addressee.

2.2.2 Object Honorification

When an object referent (that is, a direct object referent or an indirect object referent) is honoured by the speaker of an utterance, object honorification occurs.⁴ There are two ways to realize object honorification. One way is just to attach an honorific morpheme to the object NP if the verb subcategorizing for that object NP has no humble form.

- (2.5) Chulho-ka K-nim-ul cohaha-ni?
 nom hon-acc like-int
 ‘Does Chulho like K?’
 (Speaker: Minsoo, Addressee: Yongchul)

⁴Cho (1982) calls both subject honorification and object honorification referent honorification. Honorific agreement occurs between a subject NP and its corresponding verb in subject honorification, whereas in object honorification honorific agreement occurs between an object NP and its corresponding verb only when the verb has a humble form. If a verb has no humble form, object honorification is indicated only in an object NP. Thus it is necessary to distinguish these two types of honorification.

In utterance (2.5) the verb *cohaha* does not have a humble form. In this case just the attachment of the honorific suffix *nim* to the object NP *K* is needed to show that the speaker honours an object referent.

When the verb subcategorizing for an object NP has a humble form and the speaker can honour the object referent in an utterance, the humble form must be used and an honorific morpheme must also attach to the object NP.

- (2.6) Minho-ka S-kkey ku uymi-lul yeccwu-ess-e.
 nom dat (hon) the meaning-acc ask (hum)-past-dec
 'Minho asked S the meaning.'
 (Speaker: Heesoo, Addressee: Wonkil)

The verb *yeccwu* in (2.6) is a humble form of the verb *mwut* 'ask'. Since the referent of the object NP *S* has higher social status than any other persons involved in utterance (2.6), a humble form of a verb is used. If the social status of a subject referent is higher than that of an object referent, only an honorific morpheme can attach to the object NP and a humble form of a verb cannot be used even if it is available. Thus the constraint on the occurrence of object honorification is as in (2.7).

- (2.7) a. If a verb (irrespective of whether it appears in a main clause or in a subordinate clause) subcategorizing for an object NP has a humble form and the speaker can honour an object referent whose social status is higher than that of a subject referent, the use of the humble form as well as the attachment of an honorific morpheme to the object NP is required.
- b. Otherwise, the attachment of an honorific morpheme (that is, the honorific suffix *nim* or the honorific dative case marker *kkey*) to an object NP is enough.

In the case where object honorification occurs, the social status of an object referent is higher than that of the speaker and is equal to or higher than that of the addressee. When a humble form of verb is used in an utterance, the social status of an object referent is also higher than that of a subject referent.

2.2.3 Addressee Honorification

The occurrence of addressee honorification is indicated only by the honorific verbal ending appearing in an utterance.⁵

- (2.8) Y-ka ku sacin-ul ccik-ess-eyo?
 nom the picture-acc take-past-int (hon)
 'Did Y take the picture?'
 (Speaker: P, Addressee: J)

As mentioned in Section 2.1, an honorific verbal ending can be used when the speaker shows honour or courtesy to the addressee. From utterance (2.8), we cannot tell whether the speaker *P* uses the honorific verbal ending *eyo* as a way of honouring the addressee *J* (in this case the social status of the addressee is higher than that of the speaker) or as a way of being courteous to the addressee *J* (in this case the social status of the speaker is higher than that of the addressee). Thus what is certain is that the social status of the speaker is not equal to that of the addressee when an honorific verbal ending is used.

2.2.4 Multiple Honorification

More than one type of honorification can occur in a single utterance.

- (2.9) Y-nim-i R-nim-ul kitali-si-ess-ni?
 hon-nom hon-acc wait for-hon-past-int
 'Did Y wait for R?'
 (Speaker: K, Addressee: W)

In utterance (2.9) both subject honorification and object honorification occur because the honorific infix *si* appears in the verb and the honorific suffix *nim* attaches to the subject NP *Y* and the object NP *R*.

⁵Martin and Lee (1969) use the term 'speech level' instead of the term 'addressee honorification'. The latter term is adopted here to clarify the entity that is honoured.

- (2.10) P-kkeyse L-ul manna-si-ess-eyo.
 nom (hon) acc meet-hon-past-dec (hon)
 ‘P met L.’
 (Speaker: M, Addressee: H)

In utterance (2.10) addressee honorification (or courtesy to addressee) as well as subject honorification occurs because the honorific verbal ending *eyo* is used, the honorific nominative case marker *kkeyse* attaches to the subject NP *P*, and the honorific infix *si* appears in the verb.

- (2.11) W-ka H-nim-ul cohaha-yess-supnikka?
 nom hon-acc like-past-int (hon)
 ‘Did W like H?’
 (Speaker: L, Addressee: K)

In utterance (2.11) addressee honorification (or courtesy to addressee) as well as object honorification occurs because the honorific verbal ending *supnikka* is used and the honorific suffix *nim* attaches to the object NP *H*.

- (2.12) J-kkeyse L-nim-eykey chayk-ul pwuchi-si-ess-eyo.
 nom (hon) hon-dat book-acc mail-hon-past-dec (hon)
 ‘J mailed a book to L.’
 (Speaker: W, Addressee: M)

Since the honorific nominative case marker *kkeyse* attaches to the subject NP *J*, the honorific infix *si* appears in a verb, the honorific suffix *nim* attaches to the object NP *L*, and the honorific verbal ending *eyo* is used in utterance (2.12), all three types of honorification, that is, subject honorification, object honorification, and addressee honorification (or courtesy to addressee) occur there.

2.3 Previous Analyses of Honorification and A New Analysis

Honorification does not occur when one speaks to oneself. It occurs when a conversation is held between people. To determine whether an utterance is felicitous

in a dialogue, contextual information about the social status of the individuals involved in the utterance must be available and all types of honorification relevant to the utterance have to be considered at the same time.

2.3.1 Previous Analyses

Suh (1978), Kuno and Kim (1985), and Kim (1988) describe the phenomenon of subject honorification as syntactic agreement, excluding the role of dialogue participants such as the speaker and the addressee. Let us consider the examples in (2.13).

- (2.13) a. P-kkeyse ku moim-ey chamsekha-si-ess-e.
 nom (hon) the meeting-at attend-hon-past-dec
 ‘P attended at the meeting.’
 (Speaker: K, Addressee: M)
- b. P-ka ku moim-ey chamsekha-yess-e.
 nom the meeting-at attend-past-dec
 ‘P attended at the meeting.’
 (Speaker: K, Addressee: M)

According to the syntactic agreement account, the utterances in (2.13) are grammatical because syntactic agreement occurs between a subject NP and its corresponding verb. In other words, when a subject NP has an honorific morpheme, the verb also has to have an honorific morpheme as in (2.13a), whereas if a subject NP has no honorific morpheme, the verb must not have an honorific morpheme as in (2.13b). Honorification occurs when someone makes an utterance to someone else. Honorification requires not just syntactic grammaticality of an utterance, but also a relevant use of an utterance in an appropriate context. Since this syntactic agreement account neither takes into account utterance-external individuals such as the speaker and the addressee nor includes contextual information about social status, it cannot explain that the context where utterance (2.13a) can be used is different from that in which utterance (2.13b) can be used. Although both utterances in (2.13) are grammatical, the utterance in (2.13a) can be used when the social status of the referent of *P* is higher than that of the speaker *K*, whereas the utterance in (2.13b) can be used

when the social status of *K* is higher than or equal to that of the referent of *P*. Thus the syntactic agreement account cannot provide the context where an utterance can be used appropriately.

Park (1991), Han (1991), and Pollard and Sag (1994: 92-95) deal with honorification, including information about the speaker or the addressee. They describe subject honorification as pragmatic agreement, not as syntactic agreement. According to this account, the utterances in (2.13) are felicitous since the pragmatic information from the subject NP agrees with the pragmatic information from the verb (namely, in utterance (2.13a) the pragmatic information that the speaker *K* honours the referent of *P* is obtained from both the subject NP and its corresponding verb, and in utterance (2.13b) the pragmatic information that the speaker *K* does not honour the referent of *P* is obtained from both the subject NP and its corresponding verb). Although this pragmatic agreement account is better than the syntactic agreement account, it still has limitations.

First, when a humble form of a verb is not available, object honorification is indicated only in the object NP. In this case the pragmatic agreement account cannot be applied. As an example, let us consider the utterance in (2.14).

- (2.14) K-ka M-nim-ul wuski-ess-e.
 nom hon-acc make laugh-past-dec
 ‘K made M laugh.’
 (Speaker: H, Addressee: L)

There exists no humble form of the verb *wuski* and thus we cannot get any information about object honorification from that verb.⁶ The information that object honorification occurs in utterance (2.14) can be obtained from only one source, that is, the object NP *M-nim-ul*. In other words, from that object NP the pragmatic information that the speaker *H* honours the referent of *M* is obtained. From no other constituents of utterance (2.14) can pragmatic information about these two persons be obtained. In order for the notion of pragmatic agreement to be valid, there must be at

⁶On the contrary, when the verb which is used in an utterance has a humble form, information about object honorification is obtained from two sources, that is, the object NP and the verb. This means that pragmatic information about the honouring relation between the speaker and the object referent can be obtained from these two sources. In this situation it is possible to check whether the pragmatic information from the object NP agrees with that from the verb and thus the pragmatic agreement account is applicable.

least two pieces of pragmatic information. From utterance (2.14), however, we can get only one piece of pragmatic information about the honouring relation between the speaker *H* and the referent of *M*. Thus in the case of object honorification occurring in the utterance that contains a verb for which a humble form is not available, the pragmatic agreement account is not applicable.

Second, addressee honorification is indicated only in a verbal ending that is used in an utterance. As an example, let us look at the utterance in (2.15).

- (2.15) Y-ka W-lul wuski-ess-supnikka?
 nom acc make laugh-past-int (hon)
 'Did Y make W laugh?'
 (Speaker: R, Addressee: K)

In utterance (2.15), information about addressee honorification is provided by the honorific verbal ending *supnikka*. From that verbal ending the pragmatic information that the speaker *R* honours the addressee *K* is obtained. From no other constituents of utterance (2.15) can pragmatic information about the honouring relation between the speaker and the addressee of the utterance be obtained. As a result of this, only one piece of pragmatic information about the honouring relation between the speaker and the addressee is available. Thus the pragmatic agreement account cannot be applied to addressee honorification, which is related to the speaker and the addressee of an utterance, either.

Finally, the pragmatic agreement account cannot properly deal with honorification occurring in a series of utterances.

- (2.16) a. J-kkeyse P-lul chingchanha-si-ess-e.
 nom (hon) acc praise-hon-past-dec
 'J praised P.'
 (Speaker: H, Addressee: W)
- b. J-ka P-lul cohaha-ni?
 nom acc like-int
 'Does J like P?'
 (Speaker: W, Addressee: H)

The dialogue in (2.16) is held between two individuals, *H* and *W*. According to the pragmatic agreement account, pragmatic information that the speaker *H* honours the referent of *J* is obtained from utterance (2.16a) and further pragmatic information that the speaker *W* does not honour the referent of *J* is obtained from utterance (2.16b). If the pragmatic agreement account is used, there is no disagreement between these two pieces of pragmatic information with regard to the referent of *J*. Utterance (2.16b), however, is definitely used inappropriately in view of utterance (2.16a). The problem with the pragmatic agreement account is that it cannot detect the source of inappropriateness in utterance (2.16b). A detailed discussion about the source of inappropriateness and a way to find it is contained in Section 2.3.3.

2.3.2 Extracting Information about Social Status

A new analysis we propose makes explicit use of information about the underlying social status of the individuals involved in an utterance. Thus in this section let us consider how such information may be extracted. An occurrence of honorification in an utterance is indicated by honorific morphemes. From honorific morphemes and nonhonorific morphemes that are used in an utterance we can determine the relative order of social status among a subject referent, an object referent (if available), the speaker, and the addressee (Lee 1996b).

First, when the honorific nominative case marker *kkeyse* or the honorific infix *si* is used in an utterance or when the honorific suffix *nim* precedes a nominative case marker or a topic case marker, the relations shown in (2.17) are obtained.⁷

$$(2.17) \text{ Ref}_s > \text{Ref}_{sp}, \\ \text{Ref}_s \geq \text{Ref}_{ad}$$

The reason why the relation ' $\text{Ref}_s \geq \text{Ref}_{ad}$ ' holds is that if the social status of a subject referent is lower than that of the addressee, the speaker cannot use these honorific morphemes even though the social status of a subject referent is higher than that of the speaker himself. The relations in (2.17) mean that the social status of a subject referent is higher than that of the speaker and equal to or higher than that of the addressee. For example, from the nominative NP *R-kkeyse* or the honorific infix *si*

⁷The notations Ref_s , Ref_o , Ref_{sp} , and Ref_{ad} stand for a subject referent, an object referent, the speaker, and the addressee, respectively.

occurring in utterance (2.18a) we can extract the relations in (2.18b).

- (2.18) a. R-kkeyse naka-si-ess-ni?
 nom (hon) go out-hon-past-int
 ‘Did R go out?’
 (Speaker: J, Addressee: M)

b. $R > J$, $R \geq M$

Conversely, when just a nonhonorific nominative case marker or a topic case marker with no preceding honorific suffix *nim* is used or when the honorific infix *si* is not used in an utterance, the relation shown in (2.19) is obtained.

- (2.19) $\text{Ref}_{\text{sp}} \geq \text{Ref}_s$

In this case we do not need to worry about the relative order of social status between a subject referent and the addressee since any relation (i.e., higher than, equal to, or lower than) can be possible between them.

Second, when the honorific dative case marker *kkey* is used or when the honorific suffix *nim* precedes a dative case marker or an accusative case marker, the relations shown in (2.20) are obtained.

- (2.20) $\text{Ref}_o > \text{Ref}_{\text{sp}}$,
 $\text{Ref}_o \geq \text{Ref}_{\text{ad}}$

For example, from the accusative NP *Y-nim-ul* occurring in utterance (2.21a) we can obtain the relations in (2.21b).

- (2.21) a. H-ka Y-nim-ul kitali-ess-e.
 nom hon-acc wait for-past-dec
 ‘H waited for Y.’
 (Speaker: P, Addressee: J)

b. $Y > P$, $Y \geq J$

Conversely, when just a nonhonorific dative case marker or an accusative case marker with no preceding honorific suffix *nim* is used in an utterance, the relation illustrated in (2.22) is obtained.

$$(2.22) \text{Ref}_{\text{sp}} \geq \text{Ref}_o$$

Third, when a suppletive humble form of a verb is available and is used in an utterance, the relations shown in (2.23) are obtained.

$$(2.23) \begin{aligned} &\text{Ref}_o > \text{Ref}_{\text{sp}}, \\ &\text{Ref}_o \geq \text{Ref}_{\text{ad}}, \\ &\text{Ref}_o > \text{Ref}_s \end{aligned}$$

As illustrated in (2.23) the use of a humble form of a verb indicates that the social status of an object referent is higher than that of the speaker and a subject referent and is equal to or higher than that of the addressee. On the other hand, if a suppletive humble form of a verb is available and is not used in an utterance, the relation shown in (2.24) is obtained.

$$(2.24) \text{Ref}_s \geq \text{Ref}_o$$

If no humble form of a verb is available, we cannot obtain any information about social status from that verb.

Finally, when an honorific verbal ending is used in an utterance, the relation shown in (2.25) is obtained.

$$(2.25) \text{Ref}_{\text{sp}} \neq \text{Ref}_{\text{ad}}$$

The reason is that an honorific verbal ending is not used when the social status of the speaker is equal to that of the addressee. This means that the use of an honorific verbal ending indicates that the social status of the speaker is not equal to that of the addressee. For example, from the verb *tuli-ess-eyo* occurring in utterance (2.26a) we can obtain the relations in (2.26b).

- (2.26) a. P-ka H-nim-eykey choan-ul tuli-ess-eyo.
 nom hon-dat draft-acc give (hum)-past-dec
 ‘P gave a draft to H.’
 (Speaker: M, Addressee: K)

- b. H>M, H≥K, H>P (from the use of the humble verb *tuli*)
 M≥P (from no use of the honorific infix *si*)
 M≠K (from the use of the honorific verbal ending *eyo*)

Conversely, when a nonhonorific verbal ending is used in an utterance, the social status of the speaker is equal to or higher than that of the addressee as shown in (2.27).

$$(2.27) \text{Ref}_{\text{sp}} \geq \text{Ref}_{\text{ad}}$$

For instance, from the verb *sanchaykha-si-ni* occurring in utterance (2.28a) the relations in (2.28b) are obtained.

- (2.28) a. S-kkeyse sanchaykha-si-ni?
 nom (hon) take a walk-hon-int
 ‘Does S take a walk?’
 (Speaker: W, Addressee: N)
- b. S>W, S≥N (from the use of the honorific infix *si*)
 W≥N (from the use of the plain verbal ending *ni*)

Since a humble form of the verb *sanchaykha* is not available, no information about social status is obtained from it.

2.3.3 A New Analysis and Its Advantages

In every utterance it is indicated whether any of the three types of honorification occurs or not. When we look at a certain utterance, we must consider all types of honorification relevant to the utterance simultaneously. As mentioned in Section 2.3.1, not all types of honorification can be explained by agreement. Our new

analysis uses information about the social status of people involved in an utterance to determine whether honorification occurs correctly. Let us look at the utterance shown in (2.29).

- (2.29) W-ka Y-kkey selyu-lul tuli-ess-ni?
 nom dat (hon) document-acc give (hum)-past-int
 ‘Did W give a document to Y?’
 (Speaker: J, Addressee: H)

From utterance (2.29) we can extract social status information illustrated in (2.30a) and collapse it further into (2.30b) since incompatibility does not exist.

- (2.30) a. $J \geq W$ (from the NP *W-ka*)
 $Y > J, Y \geq H$ (from the NP *Y-kkey*)
 $Y > J, Y \geq H, Y > W, J \geq W, J \geq H$ (from the verb *tuli-ess-ni*)
- b. $Y > J, J \geq W, J \geq H$

It follows from (2.30b) that honorification occurs correctly in utterance (2.29). On the other hand, let us now look at the utterance shown in (2.31).

- (2.31) W-ka Y-kkey selyu-lul cwu-ess-ni?
 nom dat (hon) document-acc give-past-int
 ‘Did W give a document to Y?’
 (Speaker: J, Addressee: H)

From utterance (2.31) we can extract social status information illustrated in (2.32).

- (2.32) J≥W (from the NP *W-ka*)
 Y>J, Y≥H (from the NP *Y-kkey*)
 W≥Y, J≥W, J≥H (from the verb *cwu-ess-ni*)

At first sight, it seems that there is no incompatibility in (2.32). A closer look, however, reveals that incompatibility exists there. From $W \geq Y$ and $J \geq W$ we can infer $J \geq Y$. This inferred relation $J \geq Y$ (this relation provides information that the social

status of the referent of *Y* is not higher than that of the speaker *J*) is not compatible with the relation $Y > J$ (this relation provides information that the social status of the referent of *Y* is higher than that of the speaker *J*), which is obtained directly from a dative NP occurring in utterance (2.31). Consequently, utterance (2.31) contains incompatible information with respect to the relative order of social status between the referent of *Y* and the speaker *J*.

In the new analysis it is judged that honorification occurs correctly in an utterance only when there is no incompatibility in social status information obtained from the utterance. Otherwise, it is judged that honorification does not occur correctly. By using information about the social status of the individuals involved in an utterance, we can deal with those problems that were not solved by previous analyses.

First, the new analysis makes it possible to catch the context where an utterance can be used appropriately if no incompatibility arises in social status information obtained from the utterance. Let us consider the example utterances shown in (2.13) (repeated here as (2.33)).

- (2.33) a. *P-kkeyse* *ku* *moim-ey* *chamsekha-si-ess-e*.
 nom (hon) the meeting-at attend-hon-past-dec
 ‘P attended at the meeting.’
 (Speaker: K, Addressee: M)
- b. *P-ka* *ku* *moim-ey* *chamsekha-yess-e*.
 nom the meeting-at attend-past-dec
 ‘P attended at the meeting.’
 (Speaker: K, Addressee: M)

Although the two utterances in (2.33) have the same meaning and are made by the same speaker to the same addressee, the context where each utterance can be used is different. From utterance (2.33a) we can obtain social status information shown in (2.34a) and collapse it into (2.34b).

- (2.34) a. $P > K, P \geq M$ (from the NP *P-kkeyse*)
 $P > K, P \geq M, K \geq M$ (from the verb *chamsekha-si-ess-e*)
- b. $P > K, P \geq M, K \geq M$

Thus utterance (2.33a) can be used in the context where the social status of the referent of *P* is higher than that of the speaker *K* and equal to or higher than that of the addressee *M*, and the social status of the speaker is equal to or higher than that of the addressee. On the other hand, from utterance (2.33b) we can obtain the social status information shown in (2.35a) and collapse it into (2.35b).

- (2.35) a. $K \geq P$ (from the NP *P-ka*)
 $K \geq P, K \geq M$ (from the verb *chamsekha-yess-e*)
- b. $K \geq P, K \geq M$

Thus utterance (2.33b) can be used in the context where the social status of the speaker *K* is equal to or higher than both the referent of *P* and the addressee *M*. Therefore, without using social status information, it is not possible to know the circumstances in which an utterance can be used appropriately.

Second, the new analysis makes it possible to check whether an utterance occurring in a dialogue is used appropriately in view of its previous utterance(s) and detect the source of the inappropriate use if it is not used appropriately. Let us look at the dialogue shown in (2.16) (repeated here as (2.36)) as an example.

- (2.36) a. J-kkeyse P-lul chingchanha-si-ess-e.
 nom (hon) acc praise-hon-past-dec
 ‘J praised P.’
 (Speaker: H, Addressee: W)
- b. J-ka P-lul cohaha-ni?
 nom acc like-int
 ‘Does J like P?’
 (Speaker: W, Addressee: H)

From utterance (2.36a) we can obtain the social status information shown in (2.37a) and collapse it into (2.37b).

- (2.37) a. $J > H$, $J \geq W$ (from the NP *J-kkeyse*)
 $H \geq P$ (from the NP *P-lul*)
 $J > H$, $J \geq W$, $H \geq W$ (from the verb *chingchanha-si-ess-e*)
- b. $J > H$, $H \geq W$, $H \geq P$

On the other hand, from utterance (2.36b) we can obtain the social status information shown in (2.38a) and collapse it into (2.38b).

- (2.38) a. $W \geq J$ (from the NP *J-ka*)
 $W \geq P$ (from the NP *P-lul*)
 $W \geq J$, $W \geq H$ (from the verb *cohaha-ni*)
- b. $W \geq J$, $W \geq H$, $W \geq P$

From $J > H$ and $H \geq W$ in (2.37b) we can infer the relation $J > W$. The relation $W \geq J$ in (2.38b), however, which is obtained from utterance (2.36b), is not compatible with the relation $J > W$. Thus utterance (2.36b) is not used appropriately and the source of the problem is that the speaker of that utterance does not honour the referent of *J* (this information is obtained from the relation $W \geq J$).

Finally, the new analysis makes it possible to obtain the relative order of the social status of all individuals involved in a dialogue if no incompatibility exists in social status information. Let us consider the dialogue shown in (2.39) as an example.

- (2.39) a. *S-ka Y-nim-ul poy-ess-eyo.*
 nom hon-acc meet (hum)-past-dec (hon)
 ‘S met Y.’
 (Speaker: K, Addressee: J)
- b. *Y-kkeyse kenkangha-si-ni?*
 nom (hon) healthy-hon-int
 ‘Is Y in good health?’
 (Speaker: J, Addressee: K)

In dialogue (2.39) four individuals are involved: *S*, *Y*, and dialogue participants (i.e.,

K and *J*). From utterance (2.39a) we can obtain social status information shown in (2.40a) and collapse it into (2.40b).

- (2.40) a. $K \geq S$ (from the NP *S-ka*)
 $Y > K, Y \geq J$ (from the NP *Y-nim-ul*)
 $Y > K, Y \geq J, Y > S, K \geq S, K \neq J$ (from the verb *poy-ess-eyo*)
- b. $Y > K, Y \geq J, K \geq S, K \neq J$

From utterance (2.39b) we can obtain social status information shown in (2.41a) and collapse it into (2.41b).

- (2.41) a. $Y > J, Y \geq K$ (from the NP *Y-kkeyse*)
 $Y > J, Y \geq K, J \geq K$ (from the verb *kenkangha-si-ni*)
- b. $Y > J, J \geq K$

From the relations in (2.40b) and (2.41b) we can obtain the final information about social status, which is shown in (2.42).

- (2.42) $Y > J, J > K, K \geq S$

Thus the relations in (2.42) show the relative order of the social status of all four individuals involved in dialogue (2.39).

2.4 Effects of Honorification

Since honorification occurring in an utterance provides social status information, the form of an utterance must vary depending on the social status of people involved in the utterance. When honorification does not occur properly in an utterance, the utterance is infelicitous and furthermore a dialogue where an infelicitous utterance occurs is incoherent.

2.4.1 Felicity of Utterance

By felicity we mean that an utterance is used properly under given circumstances. Let us consider a situation where *J* delivers the message ‘*Y* saw a comet’ to *H* (that is, *J* is the speaker and *H* is the addressee). When the social status of the speaker *J* is higher than that of *Y* and the addressee *H*, no honorification occurs and thus the utterance made by the speaker *J* must be as illustrated in (2.43).

- (2.43) Y-ka hyeyseng-ul po-ass-e.
 nom comet-acc see-past-dec
 ‘Y saw a comet.’
 (Speaker: J, Addressee: H)

When the social status of *Y* is higher than that of the speaker *J* and the addressee *H*, and the social status of the addressee *H* is higher than that of the speaker *J*, both subject honorification and addressee honorification must occur as shown in utterance (2.44).

- (2.44) Y-kkeyse hyeyseng-ul po-si-ess-eyo.
 nom (hon) comet-acc see-hon-past-dec (hon)
 ‘Y saw a comet.’
 (Speaker: J, Addressee: H)

On the other hand, when the social status of *Y* is higher than that of the speaker *J* and the addressee *H*, and the social status of the speaker *J* is higher than that of the addressee *H*, only subject honorification can occur as illustrated in utterance (2.45).

- (2.45) Y-kkeyse hyeyseng-ul po-si-ess-e.
 nom (hon) comet-acc see-hon-past-dec
 ‘Y saw a comet.’
 (Speaker: J, Addressee: H)

Under the situation where the social status of the addressee *H* is higher than that of *Y* and the speaker *J*, only addressee honorification can occur as shown in utterance (2.46).

- (2.46) Y-ka hyeyseng-ul po-ass-eyo.
 nom comet-acc see-past-dec (hon)
 ‘Y saw a comet.’
 (Speaker: J, Addressee: H)

As illustrated in (2.43)-(2.46), the type of honorification that can occur in an utterance depends on the relative order of the social status of the individuals involved in that utterance. When honorification does not occur correctly in an utterance, the utterance is not used appropriately and thus it is infelicitous.

2.4.2 Coherence of Dialogue

If any of the utterances occurring in a dialogue is infelicitous, the dialogue is incoherent. Since dialogue consists of utterances, there must be no incompatibility in information about social status that is obtained from utterances. Assuming that the relative order of social status illustrated in (2.47) holds among the people involved in the dialogue shown in (2.48), let us consider that dialogue.

- (2.47) $R > Y$, $Y > S$, $S = K$

- (2.48) a. Y-kkeyse R-nim-kkey chengsacin-ul ponaytuli-si-ess-e.
 nom (hon) hon-dat (hon) blueprint-acc send (hum)-hon-past-dec
 ‘Y sent a blueprint to R.’
 (Speaker: S, Addressee: K)
- b. Y-kkeyse ku chengsacin-ul kuli-si-ess-ni?
 nom (hon) the blueprint-acc draw-hon-past-int
 ‘Did Y draw the blueprint?’
 (Speaker: K, Addressee: S)

In utterance (2.48a) subject honorification and object honorification occur, but addressee honorification does not occur. Thus utterance (2.48a) complies with the relations shown in (2.47). In utterance (2.48b) subject honorification occurs, but addressee honorification does not occur. This utterance also complies with the relations illustrated in (2.47). Consequently, the relative order of social status shown

in (2.47) is kept in all utterances occurring in dialogue (2.48) and thus the dialogue is coherent.

Honorification occurring in each utterance of a dialogue reflects the relative order of social status that holds among people involved in the dialogue. Thus under the circumstances where the relations in (2.49) hold, the appropriate dialogue is as shown in (2.50), not in (2.48).

(2.49) $R > S$, $S > Y$, $S = K$

(2.50) a. Y-ka R-nim-kkey chengsacin-ul ponaytuli-ess-e.
 nom hon-dat (hon) blueprint-acc send (hum)-past-dec
 ‘Y sent a blueprint to R.’
 (Speaker: S, Addressee: K)

b. Y-ka ku chengsacin-ul kuli-ess-ni?
 nom the blueprint-acc draw-past-int
 ‘Did Y draw the blueprint?’
 (Speaker: K, Addressee: S)

In utterance (2.50a) only object honorification occurs and in utterance (2.50b) no honorification occurs. Honorification occurring in dialogue (2.50) does not violate the relations in (2.49) and thus the dialogue is coherent.

As shown in dialogue (2.48) and dialogue (2.50), honorification must be used properly in accordance with the relative order of the social status of the individuals involved in the dialogue. If honorification is not used appropriately in a dialogue, the dialogue is incoherent.

2.5 Summary and Discussion

Honorification occurs frequently in dialogue. The occurrence of honorification is manifested by linguistic morphemes such as an honorific suffix, honorific case markers, an honorific infix, honorific verbal endings, and humble verb forms. On the basis of these specific morphemes we can tell the type of honorification (namely, subject honorification, object honorification, and addressee honorification) that occurs in an utterance. For example, if an honorific suffix precedes a dative case marker or

an accusative case marker, object honorification occurs. Since an utterance is made by the speaker, only the speaker is in a position to show honour to other individuals such as a subject referent, an object referent, and the addressee, by using specific honorific morphemes.

In previous analyses, honorification was explained as an agreement phenomenon. As far as both object honorification where a humble verb form is used and subject honorification are concerned, the agreement account is valid. The agreement account, however, cannot be applied to object honorification where a humble verb form is not available or to addressee honorification since in these cases information about honorification can be obtained from only one source, not two sources. Furthermore, the agreement account cannot provide the context where an utterance can be used appropriately and cannot explain why a certain utterance occurring in a dialogue is not used properly in view of its previous utterance(s).

The new analysis that has been presented in this chapter overcomes the limitations of previous analyses by making systematic and explicit use of information about the relative order of the social status of the individuals involved in dialogue. In the new analysis, information about social status is extracted based on specific morphemes that are used in dialogue. The extracted information about social status determines the relevant context in which an utterance can be felicitous and a dialogue can be coherent. If incompatible information is found in an utterance, that utterance is infelicitous and the dialogue where such infelicitous utterance occurs is incoherent. In addition, information about social status plays an important role when we resolve an honorific pronoun that appears in dialogue (the resolution of an honorific pronoun is discussed in Chapter 5) or recover missing constituents in dialogue (the recovery of missing constituents is dealt with in Chapter 6). Therefore, we argue that the explicit and systematic use of social status information is essential to an appropriate processing of Korean dialogue.

In the next chapter we discuss how to incorporate in the framework of HPSG (Head-Driven Phrase Structure Grammar) the new analysis, which uses information about the relative order of social status.

Chapter 3

An Information-Based Approach: Head-Driven Phrase Structure Grammar

We argued in Chapter 2 that to deal with honorification occurring in a dialogue, it is necessary to use contextual information such as information about dialogue participants, information about the honouring relation (that is, who honours whom), and information about the relative order of the social status of the individuals involved in the dialogue. To treat other linguistic phenomena occurring in a dialogue (for example, the use of honorific pronouns and the omission of constituents), we also need morphological, syntactic, and semantic information. This means that to process dialogue properly, we have to use these pieces of information. All these relevant information can be integrated easily in the feature structure of a sign within the framework of Head-Driven Phrase Structure Grammar (HPSG) (Pollard and Sag 1994). Thus the framework is appropriate to representing these kinds of information obtained from utterances of dialogue.

Since we adopt the framework of HPSG primarily on pragmatic grounds so that we can easily represent contextual information as well as morphological, syntactic, and semantic information within the framework, we are not concerned with particular theoretical details and it is not the aim of this thesis to make any significant contribution to the framework itself.

Most sentences used in naturally occurring dialogue are simple sentences containing only the main clause. Thus we use just basic schemata such as subject-head schema and complement-head schema to parse these simple sentences. The Korean language is a head-final language and thus we use different versions of complement-head schema in accordance with the number of complement daughters occurring in a sentence in order to avoid problems related to the parsing of head-final languages in Attribute Logic Engine (ALE) (Carpenter and Penn 1995). In Korean dialogue whole constituents such as the subject NP and the object NP are frequently missing if they are recoverable from context. We use a special marker ϵ to represent those missing constituents. The main reason we use such a place holder is that if it is

not used, the sentences in which more than one constituent is contiguously missing cannot be properly parsed by ALE.¹ We assign the sort *null_np* to the marker since the information provided by the marker is very different from that provided by other normal phrases and this assignment makes it easy to recognize which NP is missing in a sentence and find out the referent of a missing NP.

In section 3.1 we present the structure of signs and discuss how information from a lexical sign can be percolated to a phrasal sign. Section 3.2 shows how contextual information is formalized and incorporated in a feature structure. In section 3.3 we discuss how to obtain contextual information from an utterance and capture the context where the utterance is felicitous. The final section gives a summary of why HPSG is a framework suitable for the representation of relevant information (contextual information particularly).

3.1 A Sign System

HPSG is based on a system of signs. There are two kinds of sign: one is a lexical sign that corresponds to words and the other is a phrasal sign that corresponds to phrases, clauses or sentences. A sign is represented by a feature structure, which consists of attributes and their corresponding values.² A value itself can contain a feature structure and thus signs have a recursive structure. A lexical sign has a feature structure of the form shown in (3.1).

$$(3.1) \left[\begin{array}{ll} \text{PHON} & \text{a list of phoneme strings} \\ \text{SYNSEM} \mid \text{LOC} & \left[\begin{array}{ll} \text{CAT} & \text{a structure of sort category} \\ \text{CONT} & \text{a structure of sort content} \\ \text{CONX} & \text{a structure of sort context} \end{array} \right] \end{array} \right]$$

Phonological information about a sign can be integrated into the value of the attribute PHON, whereas syntactic, semantic, and pragmatic information can be integrated into the value of the attribute SYNSEM.

¹This problem is mentioned in the section titled 'Empty Categories' appearing in Chapter 5 of the ALE User's Guide, which is distributed together with ALE.

²Strictly speaking, *sorted* feature structures are used in HPSG. A sort tells the type of object a structure is modeling. There is a hierarchy among sorts. For example, the sort *word* and the sort *phrase* are subsorts of the sort *sign*. Since sorts do not play any important role in our use of information obtained from utterances of dialogue, we ignore them here unless they are needed. For details about sorts and their hierarchy, refer to the appendix of Pollard and Sag 1994.

A phrasal sign has the attribute DTRS as well as the attributes PHON and SYNSEM as illustrated in (3.2).

$$(3.2) \left[\begin{array}{l} \text{PHON} \text{ } a \text{ list of phoneme strings} \\ \text{SYNSEM} \mid \text{LOC} \left[\begin{array}{l} \text{CAT} \text{ } a \text{ structure of sort category} \\ \text{CONT} \text{ } a \text{ structure of sort content} \\ \text{CONX} \text{ } a \text{ structure of sort context} \end{array} \right] \\ \text{DTRS} \text{ } a \text{ structure of immediate constituents} \end{array} \right]$$

For example, when a VP consists of a ditransitive verb and its subcategorized NPs, the value of the attribute DTRS is as shown in (3.3).

$$(3.3) \left[\begin{array}{l} \text{HEAD-DTR} \text{ } a \text{ sign for the head daughter} \\ \text{COMP-DTRS} \text{ } a \text{ list of signs for complement daughters} \end{array} \right]$$

In this case a ditransitive verb is the head daughter of a VP and the NPs that are subcategorized for by the verb are complement daughters of the VP.

Certain information from a lexical sign can be percolated up to a phrasal sign by general principles (Pollard and Sag 1994: 399-403). As an example, let us consider the sentence shown in (3.4).

$$(3.4) \begin{array}{lll} \text{Heesoo-ka} & \text{sicip-ul} & \text{sa-ss-e.} \\ \text{nom} & \text{anthology-acc} & \text{buy-past-dec} \\ \text{'Heesoo bought an anthology.'} \end{array}$$

Sentence (3.4) consists of a subject NP and a VP, which is the head daughter of the sentence. The VP of sentence (3.4) again consists of an object NP and a verb, which is the head daughter of the VP. By the Head Feature Principle stated in (3.5), the HEAD value of any headed phrasal sign (for instance, a VP, an NP, and a sentence) is the same as that of its head daughter.

(3.5) Head Feature Principle:

The value of SYNSEM | LOC | CAT | HEAD in any headed phrase is

token-identical to DTRS | HEAD-DTR | SYNSEM | LOC | CAT | HEAD.³

Thus the HEAD value of sentence (3.4) is the same as that of the VP and the HEAD value of this VP is again the same as that of the verb of the sentence. The transitive verb *sa-ss-e* 'bought' in sentence (3.4) subcategorizes for a subject NP and an object NP. This is guaranteed by the Subcategorization Principle stated in (3.6).

(3.6) Subcategorization Principle:

In a headed phrase, the value of DTRS | HEAD-DTR | SYNSEM | LOC | CAT | SUBCAT is the concatenation of the value of SYNSEM | LOC | CAT | SUBCAT with the list of SYNSEM values of DTRS | SUBJ-DTR or DTRS | COMP-DTRS.

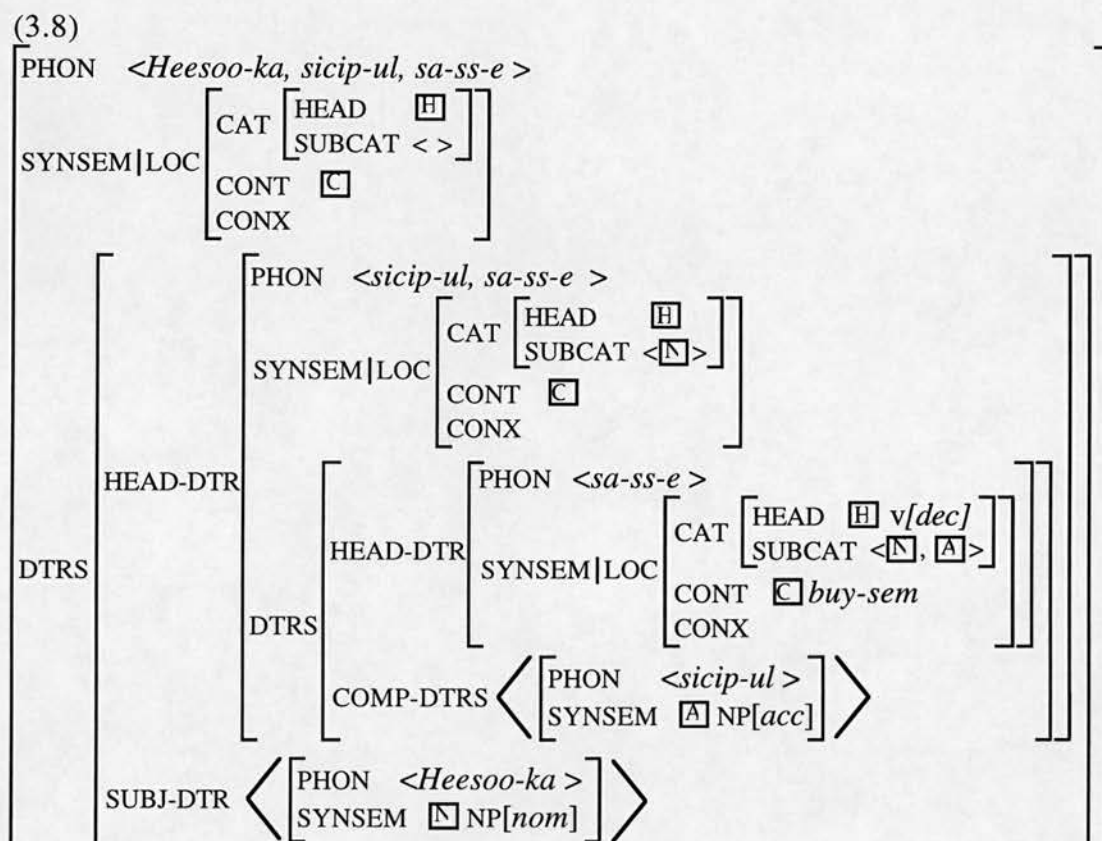
In the case of sentence (3.4), the SUBCAT value of the verb is a list consisting of the SYNSEM values of two complement daughters (namely, the subject NP and the object NP) since the SUBCAT value of the sentence itself is an empty list. The fact that the CONT value of sentence (3.4) is the same as that of its head daughter is captured by the Semantics Principle stated in (3.7).

(3.7) Semantics Principle:

The value of SYNSEM | LOC | CONT in a headed phrase is token-identical to that of the semantic head.

On the basis of the principles discussed, the feature structure of sentence (3.4) can be portrayed as illustrated in (3.8) (irrelevant details are omitted).

³This means that structure-sharing (reentrancy) may occur in feature structures (Johnson 1988: 16-18; Shieber 1986: 12-14).



Therefore, in HPSG, all lexical and phrasal signs are represented by feature structures. The percolation of information from a lexical sign to a phrasal sign is realized by the sharing of values between these two signs, in accordance with relevant principles. For a comprehensive and detailed discussion of the principles, consult

⁴The percolation of the CONX value is discussed in the subsequent section.

Pollard and Sag 1994 (a summary of the principles appears in the appendix of the work).

3.2 Advantages of the Framework: Incorporation of Contextual Information

As discussed in the previous chapter, the occurrence of honorification in a dialogue is constrained by the relative order of the social status of people involved in the dialogue. In addition, dialogue participants such as the speaker and the addressee typically change from utterance to utterance. In the framework of HPSG we can naturally incorporate information about dialogue participants, the honouring relation (that is, who honours whom), and the relative order of the social status of the individuals involved in dialogue. Let us now consider how to formalize and incorporate these kinds of contextual information.

3.2.1 Dialogue Participants

To account for honorification properly information about both the speaker and the addressee of an utterance must be used, though Pollard and Sag (1994: 92-95) do not include information about the addressee in their explanation of subject honorification in Korean. The reason is that in all three types of honorification (namely, subject honorification, object honorification, and addressee honorification) the addressee as well as the speaker is involved. For example, in order for subject honorification to occur the social status of the subject referent must be equal to or higher than that of the addressee as well as higher than that the speaker. Thus in order to deal with honorification in Korean appropriately, we have to use information about both dialogue participants, not just the speaker.

Information about dialogue participants can be integrated into the value of CONX | C-INDS as illustrated in (3.9).

$$(3.9) \quad \text{CONX | C-INDS} \left[\begin{array}{ll} \text{SPEAKER} & \text{index of speaker} \\ \text{ADDRESSEE} & \text{index of addressee} \end{array} \right]$$

An index is used to refer to an entity that is related to an utterance. If the same index

appears as the value for two different attributes in a feature structure, the values of the two attributes refer to the same entity. For example, when a person talks to himself, the index used as the value for the attribute `SPEAKER` is the same as the index used as the value for the attribute `ADDRESSEE` in the feature structure representing his utterance.

Within an utterance the speaker and the addressee do not change. This fact is captured by the Contextual Indices Inheritance Principle stated in (3.10).

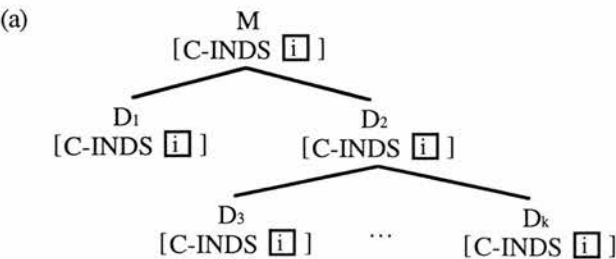
(3.10) Contextual Indices Inheritance Principle:⁵
The `CONX | C-INDS` value of a phrase is token-identical to that of each of its daughters.

Thus all words and phrases that appear in the same utterance have the same value for the attribute `C-INDS` in their feature structures.⁶

3.2.2 The Honouring Relation

When subject honorification, object honorification, or addressee honorification occurs in an utterance, the referent of a subject NP, the referent of an object NP, or the addressee is honoured by the speaker, respectively. The speaker can show honour to other individuals involved in an utterance by using relevant honorific morphemes. Thus in an utterance only the speaker is in a position to honour others. Information about the honouring relation can be integrated into the value of `CONX | HON-REL` as shown in (3.11).

⁵This principle is adapted from the Deictic Cindices Principle, whose code appears in the file `hpsg.pl` within the ALE system (Carpenter and Penn 1995).
⁶This can be portrayed as shown in (a) (irrelevant parts are ignored).



$$(3.11) \quad \text{CONX} \mid \text{HON-REL} \left\{ \begin{array}{ll} \text{REL} & \text{type of relation} \\ \text{HONOURER} & \text{index of honourer} \\ \text{HONOURED} & \text{index of honoured person} \\ \text{POLARITY} & \text{binary value (i.e., 0 or 1)} \\ \text{FORMALITY} & \text{formality of relationship} \\ & \text{between two individuals} \end{array} \right\}$$

Following Pollard and Sag (1994: 94-95), we represent the value of the attribute HON-REL as a set (represented by braces { }) of parameterized states of affairs (psoas). When a group of people, not a single person is honoured, quantification is involved and thus the value of HON-REL is a set of psos, not a set of qfpsoas (quantifier-free parameterized states of affairs).⁷ As illustrated in (3.11), each psos has five attributes: REL, HONORER, HONOURED, POLARITY, and FORMALITY. We argue that the value of REL is show-honour, not owe-honour, which is used by Pollard and Sag. The reason is that when the social status of the addressee is higher than that of an individual mentioned in an utterance, the speaker cannot show honour to that individual even though the social status of the individual is higher than that of the speaker himself (that is, even though the speaker owes honour to the individual). In other words, when honorification does not occur, it is always correct to say that the speaker does not *show* honour to an individual, whereas it is not always correct to say that the speaker does not *owe* honour to an individual. Thus the term 'show-honour' is more appropriate than the term 'owe-honour'. The value of POLARITY is either 0 or 1. If the value is 0, it means that show-honour relation does not hold between the value of the attribute HONORER and the value of the attribute HONOURED. To the contrary, if the value is 1, it means that show-honour relation holds between the value of the attribute HONORER and the value of the attribute HONOURED (namely, honorification occurs). The attribute FORMALITY is concerned with the relationship between the speaker and the addressee, which is indicated in a verbal ending.⁸ The value of FORMALITY is FORMAL when a formal verbal ending is used, whereas the value of FORMALITY is INFORMAL when an informal verbal ending is used. In other cases where such relationship cannot be obtained, the value of FORMALITY is

⁷We do not deal with quantification in this thesis and thus it is assumed that the value of the attribute QUANTS is an empty list (note that psos introduce two attributes QUANTS and NUCLEUS). For simplicity, the attribute QUANTS and its value are not included in the representation of information about honouring relations. Thus only the value of the attribute NUCLEUS is taken into account, as shown in (3.11).

⁸Since Pollard and Sag (1994: 92-95) deal with only subject honorification in Korean, the attribute FORMALITY is not taken into account in their brief discussion of honorification.

IRRELEVANT. That is, from subject honorification or object honorification, to which a verbal ending is not related, no information is obtained about whether a formal or an informal relationship holds between the speaker and a subject referent or between the speaker and an object referent. Let us look at the value of the attribute HON-REL illustrated in (3.12) as an example.

(3.12)

HON-REL

REL

show-honour

HONOURER

1

HONOURED

2

POLARITY

I

FORMALITY

irrelevant

,

REL

show-honour

HONOURER

1

HONOURED

3

POLARITY

I

FORMALITY

informal

The value of HON-REL in (3.12) is a set of two psoas. One psOA provides information that the individual indexed by 1 honours the individual indexed by 2 and it is not known whether the relationship between them is formal or informal. The other psOA provides information that the individual indexed by 1 honours the individual indexed by 3 and an informal relationship holds between them.

Information about the honouring relation in an utterance is the collection of information about honouring relations obtainable from each word appearing in the utterance. To capture this, we propose the principle stated in (3.13).

- (3.13) Honouring Relation Consistency Principle:
- The CONX | HON-REL value of a phrase is the union of the CONX | HON-REL values of all its daughters.

By means of the principle in (3.13) we can know who is honoured by the speaker or who is not honoured by the speaker in a given utterance.

3.2.3 Relative Order of Social Status

As discussed in Chapter 2, the occurrence of honorification in an utterance is constrained by the social status of the individuals involved in the utterance. This

means that in order to deal with honorification appropriately, we have to use information about social status. Although Pollard and Sag (Pollard and Sag 1994: 93) admit that such information is related to the honorification phenomena, they do not use it. Here, we argue that it is necessary to make explicit and systematic use of social status information and provide a feature-based representation to achieve this.

Information about the relative order of the social status of people involved in an utterance can be extracted from specific morphemes used in the utterance. The order of extracted social status is represented by three types of relations: higher than ($>$), equal to or higher than (\geq), and not equal to (\neq). Information about the relative order of the social status of individuals can be integrated into the value of CONX | S-STATUS, as illustrated in (3.14).⁹

$$(3.14) \quad \text{CONX | S-STATUS} \left\{ \begin{array}{l} \left[\begin{array}{ll} \text{REL} & \text{higher-relation} \\ \text{HIGHER} & \text{index of a person} \\ \text{LOWER} & \text{index of a person} \\ \text{POLARITY} & \text{binary value (i.e., 0 or 1)} \end{array} \right], \\ \left[\begin{array}{ll} \text{REL} & \text{equal-higher-relation} \\ \text{EQUAL-HIGHER} & \text{index of a person} \\ \text{EQUAL-LOWER} & \text{index of a person} \\ \text{POLARITY} & \text{binary value (i.e., 0 or 1)} \end{array} \right], \\ \left[\begin{array}{ll} \text{REL} & \text{not-equal-relation} \\ \text{NOT-EQUAL1} & \text{index of a person} \\ \text{NOT-EQUAL2} & \text{index of a person} \\ \text{POLARITY} & \text{binary value (i.e., 0 or 1)} \end{array} \right] \end{array} \right\}$$

The value of the attribute S-STATUS is a set of psoas that provide information about the relative order of social status between two individuals. In (3.14) each psOA represents a different relation: the first psOA, the second psOA, and the third psOA represent the relation ‘higher than’, the relation ‘equal to or higher than’, and the relation ‘not equal to’, respectively. A set that represents the value of S-STATUS is empty when no information about social status is obtained. Otherwise, a set can have as its elements any psoas appearing in (3.14) or their combination. As an example, let us consider the value of S-STATUS illustrated in (3.15).

⁹The reason we include information about honouring relation and information about social status in the value of CONX separately is that the former information does not always coincide with the latter information. For example, there is a case where even though the social status of a person is higher than that of another person, the latter person cannot honour the former person and thus honorification does not occur.

(3.15)

S-STATUS

REL

HIGHER

LOWER

POLARITY

higher-stat

1

2

I

REL

EQUAL-HIGHER

EQUAL-LOWER

POLARITY

equal-higher-stat

2

3

I

The value of S-STATUS in (3.15) shows that the social status of the individual indexed by 1 is higher than that of the individual indexed by 2 and that the social status of the individual indexed by 2 is equal to or higher than that of the individual indexed by 3. Thus information about the relative order of the social status of three individuals (that is, 1>2, 2≥3) is provided by (3.15).

Information about the relative order of the social status of the individuals involved in an utterance is the collection of information about social status that can be obtained from each word appearing in the utterance. This fact is captured by the principle proposed in (3.16).

- (3.16) Social Status Consistency Principle:
- The CONX | S-STATUS value of a phrase is the union of the CONX | S-STATUS values of all its daughters.

Through the principle in (3.16) we can obtain information about the relative order of the social status of all individuals involved in an utterance. Furthermore, based on this information we can obtain the context where a given utterance is felicitous.

3.3 Obtaining Contextual Information from An Utterance

In this section let us consider how to obtain contextual information from an utterance, using feature structures and principles described in the previous section. An example utterance appears in (3.17).

- (3.17)
- H-ka

Y-nim-ul

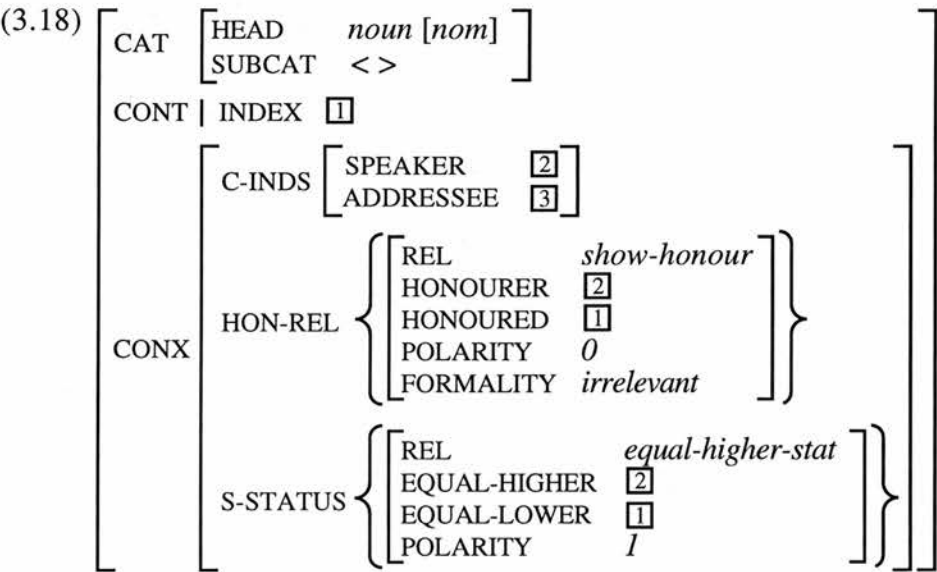
poy-ess-ni?
- nom

hon-acc

meet (hum)-past-int

‘Did H meet Y?’
(Speaker: W, Addressee: K)

In the subject NP of utterance (3.17) no honorific morpheme occurs (that is, neither an honorific suffix nor an honorific nominative case marker occurs). Thus the LOC value of the subject NP *H-ka* is as illustrated in (3.18).¹⁰



Contextual information is contained in the value of the attribute CONX. The value of CONX in (3.18) shows that the speaker does not honour a subject referent and that the social status of the speaker is equal to or higher than that of the subject referent.

The object NP of utterance (3.17) contains the honorific suffix *nim*. Thus the LOC value of the object NP *Y-nim-ul* is as shown in (3.19).

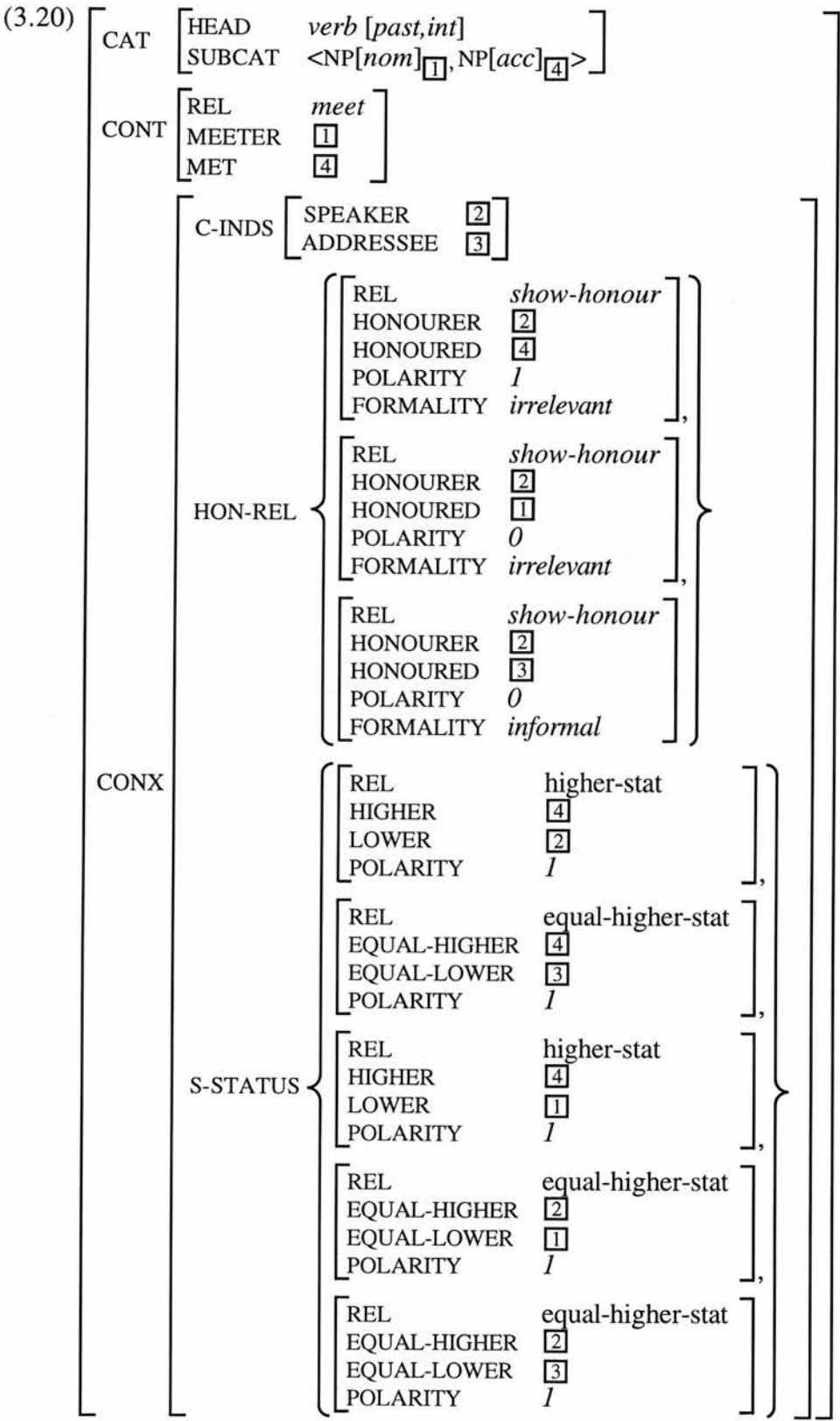
¹⁰In the actual feature structure of lexical signs corresponding to the words appearing in an utterance, there occurs no binding in the value of the attribute C-INDS among these signs until the utterance is completely parsed. For simplicity, we assume that the Contextual Indices Inheritance Principle stated in (3.10) has already applied to those lexical signs and thus the C-INDS value is identical across those signs.

(3.19)

CAT	<div> <div>HEAD</div> <div>noun [acc]</div> </div> <div> <div>SUBCAT</div> <div>< ></div> </div>
CONT	INDEX 4
	<div> <div>C-INDS</div> <div> <div>SPEAKER 2</div> <div>ADDRESSEE 3</div> </div> </div>
	<div> <div>HON-REL</div> <div> <div>REL show-honour</div> <div>HONOURER 2</div> <div>HONOURED 4</div> <div>POLARITY 1</div> <div>FORMALITY irrelevant</div> </div> </div>
CONX	<div> <div>S-STATUS</div> <div> <div>REL higher-stat</div> <div>HIGHER 4</div> <div>LOWER 2</div> <div>POLARITY 1</div> </div> </div>
	<div> <div>S-STATUS</div> <div> <div>REL equal-higher-stat</div> <div>EQUAL-HIGHER 4</div> <div>EQUAL-LOWER 3</div> <div>POLARITY 1</div> </div> </div>

The value of CONX in (3.19) shows that the speaker honours an object referent and that the social status of the object referent is higher than that of the speaker and is equal to or higher than that of the addressee.

Although neither an honorific infix nor an honorific verbal ending occurs in the verb of utterance (3.17), the verb *poy* is a humble form of the verb *manna*. Thus the LOC value of the verb *poy-ess-ni* is as illustrated in (3.20).



The value of CONX in (3.20) provides information that the speaker honours only an object referent. It also provides information that the social status of the object referent is higher than that of the speaker and a subject referent and is equal to or higher than that of the addressee and that the social status of the speaker is also equal to or higher than that of the subject referent and the addressee.

When we look at the values of HON-REL and S-STATUS illustrated in (3.18)-(3.20), there is no incompatible information. Thus the utterance in (3.17) is used properly. The context where utterance (3.17) can be used properly is captured by collecting information about social status based on Social Status Consistency Principle stated in (3.16) and computing the order contained in the information. The result is as shown in (3.21).

(3.21) $[4] > [2]$, $[2] \geq [1]$, $[2] \geq [3]$

From the order in (3.21), we know that utterance (3.17) is felicitous under the context where the social status of the object referent is higher than that of the other individuals involved in the utterance and the social status of the speaker is equal to or higher than that of the subject referent and the addressee. Therefore, information about social status obtained from an utterance enables us to capture the context where the utterance is felicitous.

3.4 Summary

In the framework of HPSG, all relevant information is represented as a single feature structure or sign. Contextual information as well as morphological, syntactic, and semantic information can be incorporated. Some information can be shared between lexical signs and phrasal signs by general principles. For example, since the speaker and the addressee do not change within a single utterance, the C-INDS value of all words occurring in an utterance must be identical to the C-INDS value of the utterance. This fact is guaranteed by the Contextual Indices Inheritance Principle.

Contextual information such as dialogue participants (i.e., the speaker and the addressee), the honouring relation, and the relative order of the social status of the individuals involved in each utterance of dialogue is indispensable to the explanation of honorification occurring in dialogue. In particular, information about social status makes it possible to identify the context where a given utterance is felicitous. All these

pieces of contextual information can be easily and systematically integrated in the framework of HPSG. Thus the framework is adopted for the representation of information obtained from utterances of dialogue. Since we use the framework just to represent information, the interpretation of information is made not within the framework itself, but by the dialogue manager that is discussed in chapter 7.

We consider how to represent a whole dialogue in the next chapter, while paying special attention to the flow of information about social status between utterances, by extending and modifying DRT (Discourse Representation Theory).

Chapter 4

Dialogue Representation

Unlike in discourse where a narration is given by a single person, in dialogue the dialogue participants such as the speaker and the addressee may change from utterance to utterance. Without using information about dialogue participants for each utterance occurring in dialogue, honorification phenomenon cannot be accounted for, missing constituents cannot be recovered, and honorific pronouns cannot be resolved. In addition, the processing of a non-initial utterance requires not only information obtained from its preceding utterance(s) but also more detailed information such as which information comes from which preceding utterance. A constituent may be missing even in a dialogue-initial utterance and information about the form of the utterance is needed to recover the missing constituent. Thus in the structure representing a dialogue, all relevant information must be included.

In section 4.1 the framework of DRT and the limitations in its application to dialogue are discussed. In section 4.2 we propose a dialogue representation theory that incorporates contextual and non-contextual information which is needed to deal with dialogue properly. The section 4.3 shows how to detect whether a dialogue is coherent or not, on the basis of information flow that is utilized in our dialogue representation theory. The final section gives a summary of how to represent dialogue appropriately.

4.1 Discourse Representation Theory

DRT deals with discourse, which consists of sentences, and constructs a structure that represents discourse. Pronouns appearing in discourse are resolved on the basis of the notion of accessibility. It depends on the structure of a discourse whether or not discourse referents related to a sentence of the discourse are available to following sentences. When the referent corresponding to the antecedent of a pronoun is available to the sentence in which the pronoun occurs, the pronoun can be resolved. Otherwise, DRT judges that the pronoun cannot be resolved.

4.1.1 Framework

In DRT (Kamp 1981; Kamp and Reyle 1993) the semantic interpretation of a discourse is represented by a Discourse Representation Structure (DRS). A DRS has two components: a set of discourse referents and a set of DRS-conditions. For example, the discourse in (4.1) is represented by the DRS shown in (4.2).

- (4.1) a. A man watched an opera.
b. He liked it.

(4.2)

x, y
$\text{man}(x)$ $\text{opera}(y)$ $\text{watched}(x,y)$ $\text{liked}(x,y)$

The DRS illustrated in (4.2) has two discourse referents and four DRS-conditions. In DRT the resolution of an anaphor is based on the notion of accessibility, which is a relation between discourse referents and DRS-conditions. The definition of accessibility is as stated in (4.3).

- (4.3) A discourse referent x is accessible from a DRS-condition Ω in a DRS K if
- (a) K does not contain any other DRSs or
 - (b) there are DRSs K_1 and K_2 such that K_2 is subordinate to K_1 and K_1 is subordinate to K and that x is a discourse referent of K_1 and Ω is a DRS-condition of K_2 .

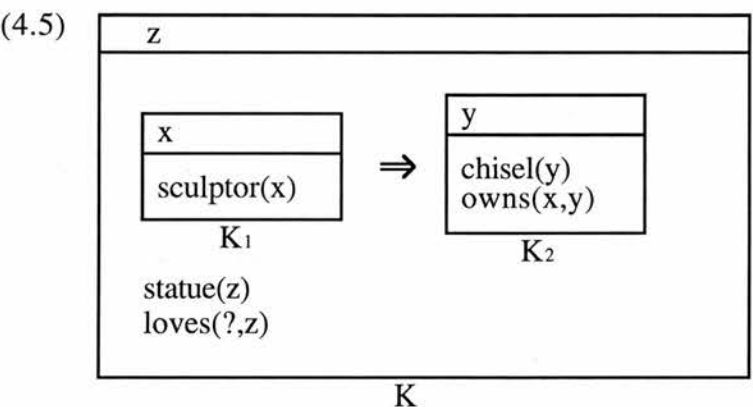
An anaphor can be resolved when its referent is accessible from the DRS-condition to which the anaphora is related. In (4.2) there is only one DRS and thus all its discourse referents (that is, x and y) are accessible from any of its DRS-conditions, including the condition $\text{liked}(x,y)$. Thus the pronouns appearing in (4.1b) can be resolved to their

appropriate referents.¹

Let us now consider a discourse where an anaphor that cannot be resolved occurs as shown in (4.4).

- (4.4) a. Every sculptor owns a chisel.
b. He loves a statue.

The reason why the pronoun in (4.4b) is not resolvable is that its relevant referent is not accessible from the DRS-condition to which the pronoun is related. This is illustrated in (4.5).



Three DRSs (that is, **K**, **K₁**, and **K₂**) appear in (4.5). Since DRS **K₂** is subordinate to DRS **K₁**, the discourse referent **x** in **K₁** is accessible from any of the DRS-conditions in **K₂**. On the other hand, both **K₁** and **K₂** are subordinate to the main DRS **K** in (4.5). While the discourse referent **x** appears in **K₁**, the DRS-condition to which the pronoun in (4.4b) is related appears in **K**. The DRS **K**, however, is not subordinate to the DRS **K₁**. This means that the discourse referent **x** is not accessible from the DRS-condition

¹In Montague Grammar (Montague 1974; Dowty 1979; Dowty, Wall, and Peters 1981), which follows the principle of compositionality stated in (a), the interpretation of discourse (4.1) would be as shown in (b).

- (a) The Principle of Compositionality:
The meaning of an expression is a function of the meaning of its components and their mode of combination.
- (b) $\exists x [\text{man}(x) \wedge \exists y [\text{opera}(y) \wedge \text{watched}(x,y)]] \wedge \text{liked}(x,y)$

The problem with (b) is that the variables **x** and **y** in **liked(x,y)** are not bound by the existential quantifier. Thus the cross-sentential anaphoric link in discourse (4.1) cannot be explained in Montague Grammar.

to which the pronoun is related. Thus the pronoun in (4.4b) cannot be resolved.

4.1.2 Limitations

Although DRT can deal with inter-sentential anaphora occurring in discourse, it has a number of limitations when we try to apply it to dialogue.

First, since DRT does not consider dialogue participants such as the speaker and the addressee, information about them is not included in DRT. Without using information about dialogue participants, however, we cannot explain honorification, cannot capture the context where an utterance is felicitous, and cannot detect infelicity of utterance or incoherence of dialogue.

Second, in DRT there is no indication of which part of the DRS representing a whole discourse corresponds to the representation of which sentence of the discourse. For example, let us consider the discourse shown in (4.6).

- (4.6) a. A man played a violin.
- b. The audience applauded him.
- c. He was happy.

The DRS that represents discourse (4.6) is as illustrated in (4.7).

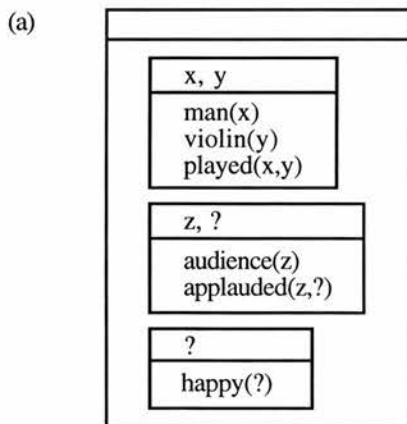
(4.7)	<table><tr><th>x, y, z</th></tr><tr><td>man(x) violin(y) played(x,y) audience(z) applauded(z,x) happy(x)</td></tr></table>	x, y, z	man(x) violin(y) played(x,y) audience(z) applauded(z,x) happy(x)
x, y, z			
man(x) violin(y) played(x,y) audience(z) applauded(z,x) happy(x)			

In DRS (4.7) there is no separate and distinct structure representing each sentence of

discourse (4.6).² To deal with dialogue, however, in which the speaker and the addressee typically change from utterance to utterance, honorification occurs, constituents are missing, or honorific pronouns appear, we need a separate structure that represents each utterance of dialogue explicitly. For example, the recovery of a missing constituent in an utterance that does not occur initially in dialogue needs information from its first preceding utterance (that is, its immediately preceding utterance), its second preceding utterance, or other preceding utterance(s). Without a separate representation structure for each utterance, we cannot know which information is obtained from which utterance and thus cannot recover a missing constituent appropriately.³

In Segmented Discourse Representation Theory (SDRT) (Asher 1993), segments of a discourse are represented by a Segmented Discourse Representation Structure (SDRS). An SDRS is composed of a pair of sets: a set of DRSs or SDRSs and a set of SDRS conditions on them. The form of an SDRS condition is $R(\mu_1, \mu_2)$ (where μ_1 and μ_2 represent a DRS or a SDRS, and R stands for a discourse relation such as *continuation*, *narration*, *elaboration*, *explanation*, *result*, *evidence*, *contrast*, *parallel*, and *background*).⁴ For example, the discourse shown in (4.6) can be represented by the SDRS illustrated in (4.8).

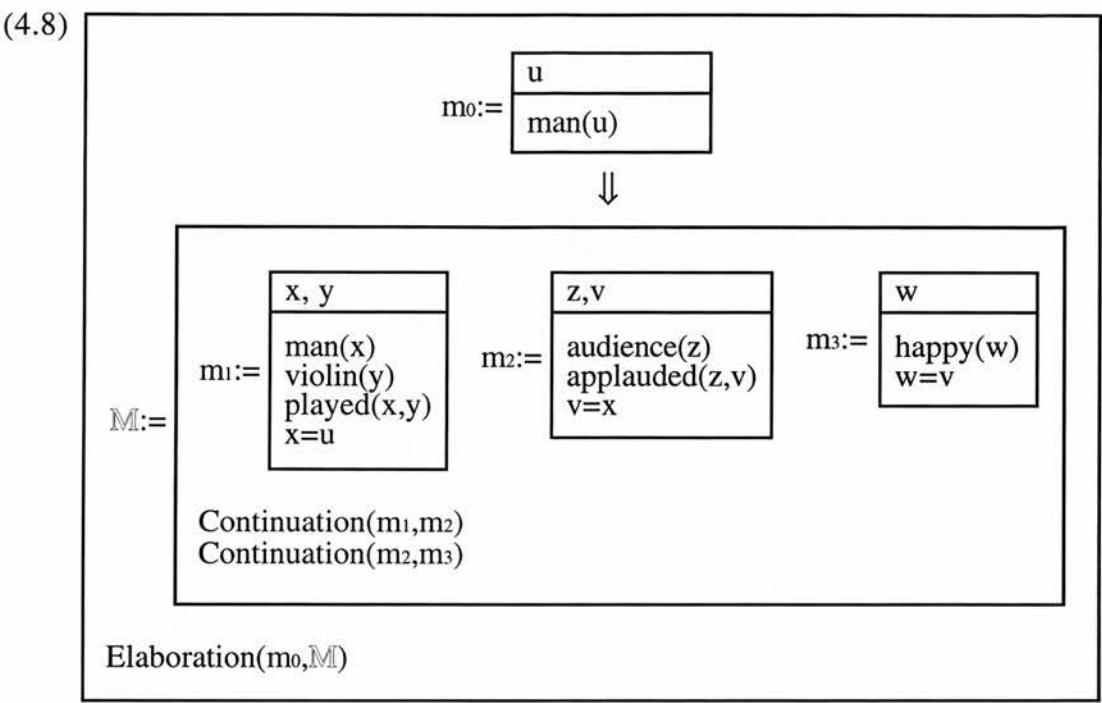
²We may want to represent discourse (4.6) by the DRS shown in (a) to illustrate clearly the structure representing each sentence.



The problem with (a), however, is that pronouns in discourse (4.6) cannot be resolved because the discourse referent x is not accessible from other DRSs except the DRS where it first appears.

³The detailed discussion on the recovery of missing constituents is contained in Chapter 6.

⁴Methods for determining the discourse relation that holds between segments of a discourse are discussed in the theory of DICE (Discourse and Commonsense Entailment) (Asher and Lascarides 1994; Lascarides 1995; Lascarides and Asher 1991; Lascarides and Asher 1993; Lascarides, Asher, and Oberlander 1992; Lascarides and Oberlander 1993).



In (4.8) the DRSs m_1 , m_2 , and m_3 represent the sentences (4.6a), (4.6b), and (4.6c), respectively. Since the discourse relation *continuation* induces topic-based updating, the DRS m_0 appears in (4.8), though it does not correspond to any sentence of discourse (4.6). Thus in SDRT it is possible to recognize which structure represents which sentence of a discourse. The theory, however, does not take into account dialogue participants and thus it is not suitable to representing dialogue, in which the speaker and the addressee may vary from utterance to utterance.

Finally, to recover a missing constituent in a dialogue-initial utterance we need information about whether the utterance takes a declarative form or an interrogative form. That kind of information, however, is not represented in DRT. Let us look at why information about the form of an utterance is needed using two example utterances shown in (4.9) on the assumption that both of them occur as the first utterance of dialogue.

- (4.9) a. ecey e yenghwa-lul po-ass-ni?
yesterday movie-acc watch-past-int
'Did you watch a movie yesterday?'
(Speaker: Y, Addressee: P)

- b. ecey e yenghwa-lul po-ass-e.
 yesterday movie-acc watch-past-dec
 ‘I watched a movie yesterday.’
 (Speaker: Y, Addressee: P)

In the two utterances shown in (4.9) a subject NP is missing. The only difference between them is that the form of utterance (4.9a) is interrogative (this information is provided by the interrogative verbal ending *ni*), whereas the form of utterance (4.9b) is declarative (this information is provided by the declarative verbal ending *e*). Since the referent of a missing NP in a dialogue-initial interrogative utterance is the addressee and the referent of a missing NP in a dialogue-initial declarative utterance is the speaker, the referent of a missing subject NP in (4.9a) is different from that in (4.9b). Thus the form of an utterance plays a central role in the recovery of a missing NP in a dialogue-initial utterance.

4.2 Dialogue Representation Theory

We propose a dialogue representation theory that takes account of information about dialogue participants, social status information, and the form of each utterance occurring in dialogue. These pieces of information are necessary to deal with dialogue, in which honorification occurs, constituents of an utterance are missing, and honorific pronouns appear. Since a dialogue referent is a DRS that represents the content of the message conveyed by an utterance, information coming from an utterance is available when its subsequent utterance is processed. Furthermore, each dialogue condition represents an utterance occurring in dialogue and thus it is possible to determine which information comes from which utterance.

4.2.1 Extension of Discourse Representation Theory

As pointed out in section 4.1.2, DRT cannot deal with dialogue properly. Thus we extend and modify DRT based on Conversation Representation Theory (Poesio 1994;

Poesio 1995; Poesio and Traum 1995).⁵

First, we capture the form of an utterance by using the notion of locutionary act. We call the act of uttering an utterance whose main verb contains a declarative verbal ending the locutionary act *say* and call the act of uttering an utterance whose main verb contains an interrogative verbal ending the locutionary act *inquire*.⁶ Consequently, if an utterance takes a declarative form, the locutionary act *say* occurs, whereas if an utterance takes an interrogative form, the locutionary act *inquire* occurs. The type of a locutionary act is used as a predicate for the representation of an utterance. Thus while the locutionary act *say* is used as a predicate for representing an utterance that takes a declarative form, the locutionary act *inquire* is used as a predicate for representing an utterance that takes an interrogative form.

Second, we incorporate information about the speaker and the addressee of an utterance occurring in dialogue in the first argument and the second argument of the predicate that is the type of a locutionary act for the utterance, respectively.

Finally, we incorporate the content of the message (including social status information) conveyed by an utterance in the last argument of the predicate that is the type of a locutionary act for the utterance. This last argument itself takes the form of a DRS and is labeled *msg*. As an example, let us look at the utterance shown in (4.10).

- (4.10) Koo cenmwu-nim-i chengsacin-ul pat-usi-ess-ni?
 executive director-hon-nom blueprint-acc receive-hon-past-int
 'Did executive director Koo receive a blueprint?'
 (Speaker: Chulho, Addressee: Heesoo)

In utterance (4.10) an interrogative verbal ending is used and subject honorification occurs. Thus utterance (4.10) can be represented as illustrated in (4.11).

⁵Conversation Representation Theory is more concerned with the inference of mental states (for example, intentions, beliefs, and goals) of dialogue participants, using the notion of conversational events than with linguistic phenomena occurring in dialogue, though it deals with reference resolution. Thus we do not go into details of the theory.

⁶There are other types of locutionary acts such as *request* (this locutionary act occurs when an imperative verbal ending appears in the main verb of an utterance) and *suggest* (this locutionary act occurs when a propositive verbal ending appears in the main verb of an utterance). For discussion about speech acts, refer to Searle 1969, Searle 1979, Levinson 1983, and Sperber and Wilson 1986.

(4.11)	<table><tr><td>x,y,z,u</td></tr><tr><td>named(x,chulho) named(y,heesoo) named(z,executive director koo) blueprint(u) received(z,u) higher(z,x) equal higher(x,y)</td></tr></table>	x,y,z,u	named(x,chulho) named(y,heesoo) named(z,executive director koo) blueprint(u) received(z,u) higher(z,x) equal higher(x,y)
x,y,z,u			
named(x,chulho) named(y,heesoo) named(z,executive director koo) blueprint(u) received(z,u) higher(z,x) equal higher(x,y)			
inquire(chulho,heesoo,msg:)		

Utterance (4.10) takes an interrogative form and thus the locutionary act *inquire* occurs as shown in (4.11). Information about who are the speaker and the addressee of utterance (4.10) is also included. The DRS containing the content of the message conveyed by the utterance is labeled *msg*.⁷ The three individuals involved in the utterance are indicated by the predicate *named*. Since information about social status plays an important role in the explanation of honorification, the recovery of a missing constituent, and the resolution of an honorific pronoun, that information is indicated by a predicate such as *higher*, *equal higher*, or *not equal*. Thus the skeletal structure that represents an utterance is as shown in (4.12).

(4.12) *a locutionary act (speaker, addressee, msg: DRS (the structure representing message content and social status information))*

Each utterance occurring in a dialogue is represented by the structure shown in (4.12). Thus we can clearly recognize which structure represents which utterance and in the processing of a non-initial utterance we can use information obtained from its first preceding or second preceding utterance.

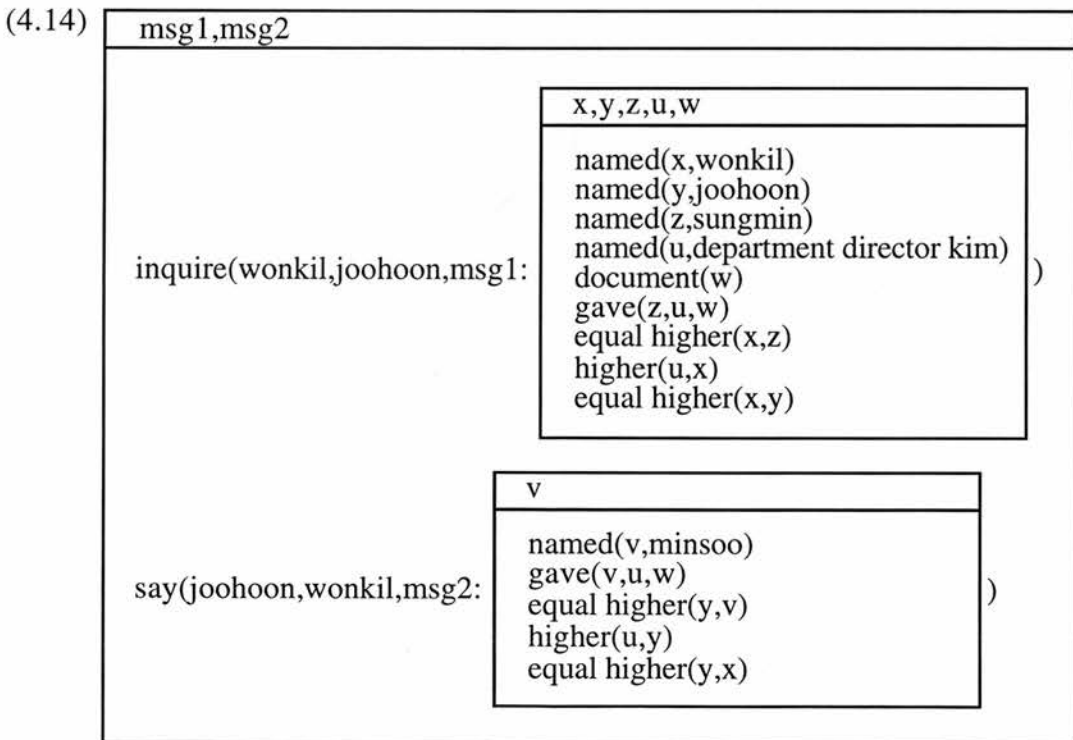
4.2.2 Representation of Information Flow among Utterances

In the representation of a dialogue the flow of relevant information among utterances occurring in that dialogue must be indicated. The flow of information among utterances is captured by making information that is obtained from a certain utterance available to all its subsequent utterances. To see how information flow is represented, let us consider the dialogue shown in (4.13).

⁷By using *msg* as a dialogue referent in dialogue representation structure, it is possible to capture information flow among utterances. A detailed discussion about the role of *msg* is made in the subsequent section.

- (4.13) a. Sungmin-i Kim pwucang-nim-eykey selyu-lul
nom department director-hon-dat document-acc
tuli-ess-ni?
give (hum)-past-int
'Did Sungmin give a document to department director Kim?'
(Speaker: Wonkil, Addressee: Joohoon)
- b. Minsoo-ka e e tuli-ess-e.
nom give (hum)-past-dec
'Minsoo gave it to him.'
(Speaker: Joohoon, Addressee: Wonkil)

In utterance (4.13b) both an indirect object NP and a direct object NP are missing. To recover these missing constituents information that is obtained from its preceding utterance must be available. The representation structure for dialogue (4.13) is as illustrated in (4.14).



As shown in (4.14), the DRS representing the content of the message conveyed by the

first utterance of dialogue is labeled *msg1* and the DRS representing the content of the message conveyed by the second utterance is labeled *msg2*. In other words, both *msg1* and *msg2* refer to a DRS. Since *msg1* and *msg2* are used as dialogue referents, a DRS itself may be used as a dialogue referent. In a dialogue referent information about all entities (including persons) related to an utterance is incorporated. The use of a DRS as a dialogue referent makes it possible for information obtained from an utterance to flow into its subsequent utterance(s). For example, when the utterance in (4.13b) is processed, information about entities related to its previous utterance (i.e., utterance (4.13a)) is available since a DRS containing that information is accessible as illustrated in (4.14). Thus, although only a referent that is newly introduced in utterance (4.13b) appears in the referent component of a DRS labeled by *msg2*, all referents appearing in a DRS labeled by *msg1* are also available to the DRS labeled by *msg2*.⁸ By using this mechanism of information flow, we can check whether an utterance occurring in dialogue is felicitous, can recover a constituent missing in an utterance, and can resolve an honorific pronoun.

4.2.3 Dialogue Representation Structure

As briefly illustrated in the previous section, the structure that represents a dialogue is composed of two parts: a set of dialogue referents and a set of conditions representing each utterance occurring in the dialogue. The outline of the representation structure for a dialogue consisting of *n* utterances is as shown in (4.15).

(4.15)	<div style="border: 1px solid black; padding: 2px;"> <i>msg1,msg2 ... msg(n-1),msg(n)</i> </div> <div style="border: 1px solid black; padding: 10px;"> <i>a locutionary act (speaker1,addressee1,msg1: DRS1)</i> <i>a locutionary act (speaker2,addressee2,msg2: DRS2)</i> <div style="text-align: center;"> <i>.</i> <i>.</i> <i>.</i> </div> <i>a locutionary act (speaker(n-1),addressee(n-1),msg(n-1): DRS(n-1))</i> <i>a locutionary act (speaker(n),addressee(n),msg(n): DRS(n))</i> </div>
--------	---

⁸Although the ordering of message contents conveyed by utterances is not explicitly specified in (4.14), the dialogue manager that is explained in Chapter 7 can recognize which message content is conveyed by which utterance and the ordering of message contents based on the positive integer appearing in the label referring to a DRS. In Conversation Representation Theory, which uses the notion of conversational events, the ordering of such events is not specified, either.

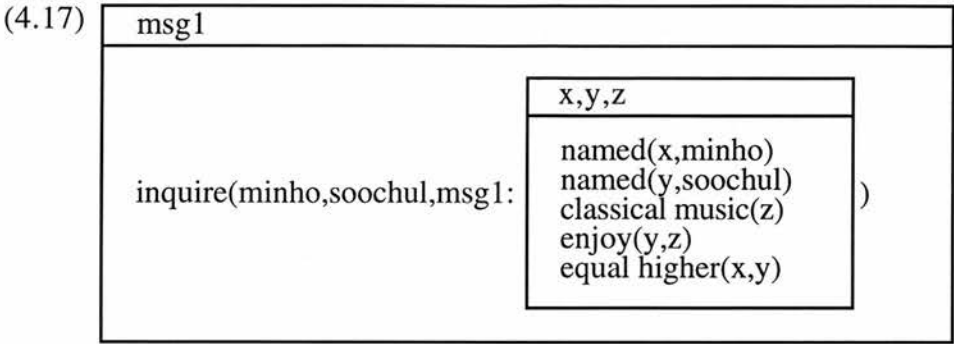
If there are n utterances in a dialogue, n dialogue referents and n conditions appear in the representation structure of the dialogue as illustrated in (4.15). A dialogue referent does not refer to a single entity that stands for a person or a thing, but refers to a DRS representing the content of the message conveyed by an utterance. In the processing of an utterance this mechanism makes it possible to use information obtained from its preceding utterances. Furthermore, each condition appearing in the representation structure of a dialogue corresponds to the representation of a single utterance. Thus we can locate the condition to be used when the processing of an utterance needs information obtained from its first preceding utterance or its second preceding utterance. As an example, let us consider the dialogue shown in (4.16).

- (4.16) a. ϵ kocen umak-ul culki-ni?
 classic music-acc enjoy-int
 'Do *you* enjoy classical music?'
 (Speaker: Minho, Addressee: Soochul)
- b. Youngsoo-ka ϵ culki-e.
 nom enjoy-dec
 'Youngsoo enjoys *it*.'
 (Speaker: Soochul, Addressee: Minho)
- c. ϵ yencwuhoy-ey cacwu ka-ni?
 concert-postp frequently go-int
 'Does *he* go to a concert frequently?'
 (Speaker: Minho, Addressee: Soochul)

The dialogue in (4.16) is held between two persons, *Minho* and *Soochul*. In the first utterance and the third utterance a subject NP is missing, whereas in the second utterance an object NP is missing. To recover a missing constituent in the dialogue-initial utterance, we must use information about dialogue participants and the form of the utterance. To recover a missing constituent in other utterances, we must use information obtained from their preceding utterance(s). Thus in the structure representing a dialogue these pieces of information must be specified. Let us now consider how to construct the representation structure of dialogue (4.16).

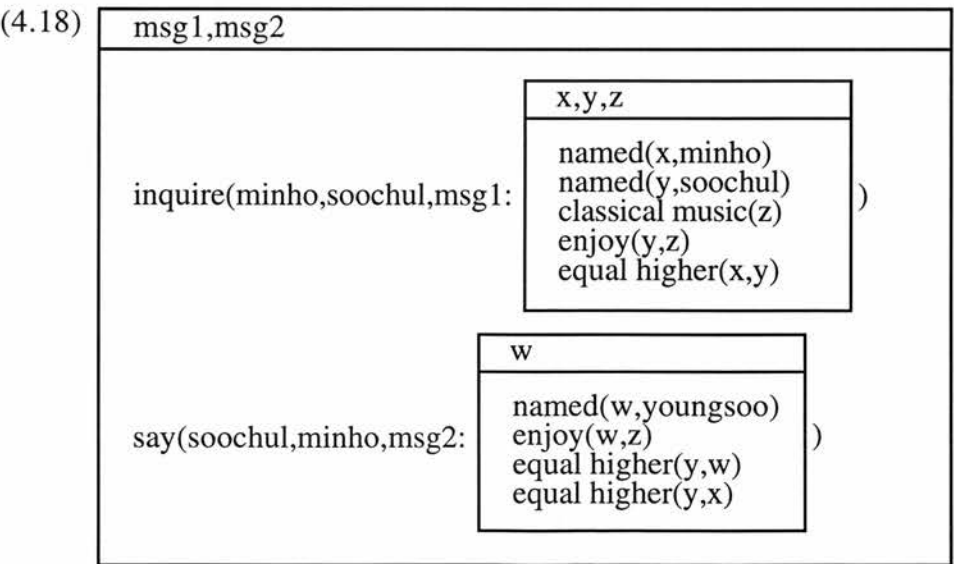
The first utterance of dialogue (4.16) takes an interrogative form and thus the

referent of the missing subject NP in the utterance is the addressee. Consequently, the structure illustrated in (4.17) is obtained after the first utterance is processed.



In the first utterance the subject referent is the addressee and honorification does not occur. Thus information that the social status of the speaker is equal to or higher than that of the addressee is obtained as shown in (4.17).

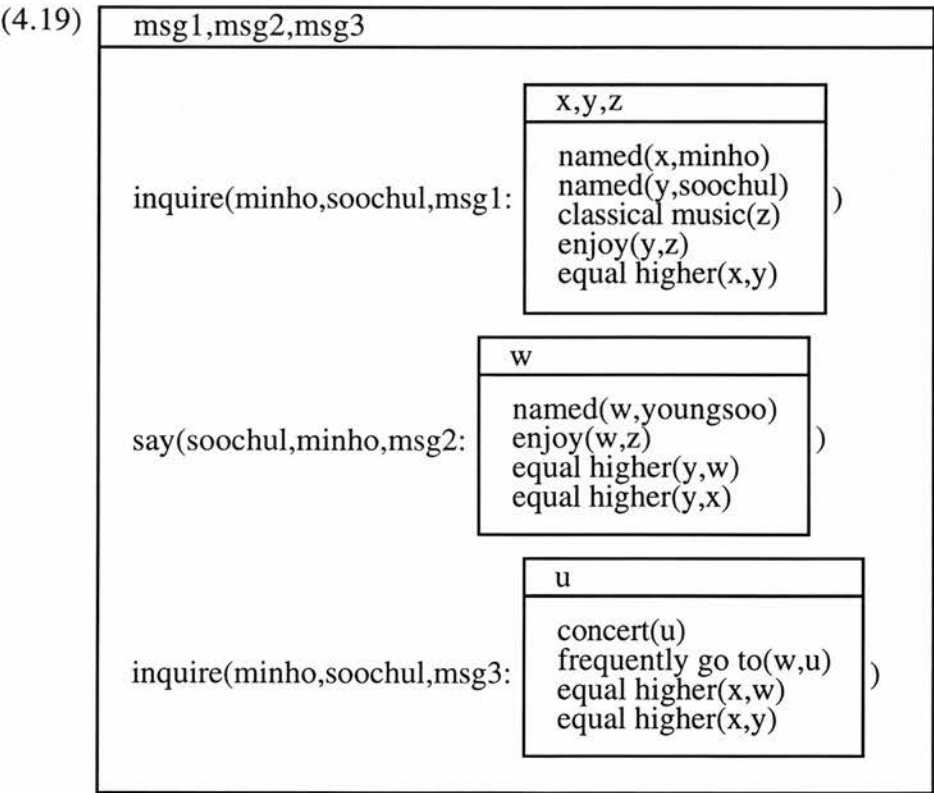
In the second utterance the referent of the missing object NP is the same as that of the object NP in its immediately preceding utterance (that is, the first utterance) since the same main verb is used in both utterances.⁹ Thus the recovery of a missing constituent in the second utterance depends on information obtained from the first utterance. After these two utterances are processed, the structure representing them is as illustrated in (4.18).



⁹The thorough analysis of the recovery of missing constituents in an utterance whose main verb is the same as that of the preceding utterance is made in the first section of Chapter 6.

Since the DRS representing the content of the message conveyed by the first utterance is a dialogue referent, all the referents appearing in the first utterance are automatically available when the second utterance is processed. Thus it is possible to recover a missing constituent in the second utterance based on information coming from the first utterance.

When the final utterance in dialogue (4.16) is processed, all information obtained from its previous two utterances is available. In addition, it is possible to recognize which information comes from which utterance. Since the referent of the missing subject NP in the final utterance is the same as that of the subject NP in its immediately preceding utterance, we must again use information coming from that utterance to recover the missing constituent. After all utterances in dialogue (4.16) are processed, the structure illustrated in (4.19) is obtained.



Thus the structure shown in (4.19) represents the dialogue in (4.16). As illustrated in (4.17)-(4.19), the structure representing a dialogue is constructed incrementally and compositionally since each dialogue condition is built after each utterance is processed.

4.3 Detection of Incoherent Dialogue

When incompatibility arises in the information obtained from utterances occurring in a dialogue, the dialogue is incoherent. By making use of the flow of information between utterances, it is possible to detect whether a dialogue is coherent or not. As an example, let us look at the dialogue appearing in (4.20).

- (4.20)

a.

Choi

cenmwu-nim-kkeyse

Kim

pwucang-nim-ul

executive director-hon-nom (hon)

department director-hon-acc

kitali-si-ess-e.

wait for-hon-past-dec

'Executive director Choi waited for department director Kim.'

(Speaker: Sungkoo, Addressee: Hochul)
- b.

Kim

pwucang-i

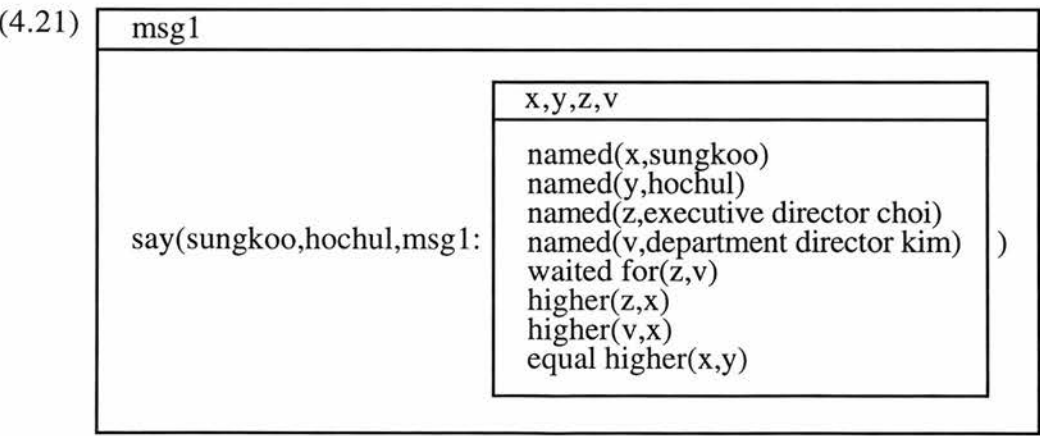
choan-ul

caksengha-yess-ni?
- department director-nom

draft-acc

make out-past-int
- 'Did department director Kim make out a draft?'
- (Speaker: Hochul, Addressee: Sungkoo)

The utterance in (4.20a), which is the initial utterance of dialogue (4.20), takes a declarative form. Both subject honorification and object honorification occur in the utterance. Thus, after the utterance is processed, we get the interim dialogue representation structure illustrated in (4.21).



The DRS labeled *msg1*, which represents the content of the message conveyed by

utterance (4.20a), provides the information that the social status of both the subject referent and the object referent of the utterance is higher than that of the speaker and that the social status of the speaker is again equal to or higher than that of the addressee. On the other hand, in utterance (4.20b) no honorification occurs and the utterance takes an interrogative form. Thus the structure illustrated in (4.22) represents utterance (4.20b).

(4.22)

inquire(hochul,sungkoo,msg2:

w
draft(w) make out(v,hochul) equal higher(y,v) equal higher(y,x)

Since the DRS containing information obtained from utterance (4.20a) is a dialogue referent, as shown in (4.21), all information provided by the DRS is available when utterance (4.20b) is processed. In other words, information flow occurs between the two utterances. Although no incompatibility occurs in the social status information provided by the DRS in (4.22) itself, some information is not compatible with the information provided by the DRS in (4.21). The information *equal higher(y,v)* in (4.22) is incompatible with the information *higher(v,y)*, which can be inferred from the two pieces of information *higher(v,x)* and *equal higher(x,y)* in (4.21). This means that utterance (4.20b) provides information incompatible with the one provided by utterance (4.20a). It follows from this incompatibility that the dialogue in (4.20), which is composed of these two utterances, is incoherent. Thus the incoherence of dialogue (4.20) can be detected by using the mechanism of information flow that is incorporated in our dialogue representation theory. Since the dialogue in (4.20) is incoherent, we cannot get a dialogue representation structure corresponding to that dialogue.

4.4 Summary

To represent a dialogue where honorification occurs, a constituent of an utterance is missing, or an honorific pronoun appears, we must use information about the form of an utterance and information about the speaker and the addressee of an utterance, and get information coming from an utterance to flow into all its subsequent utterances.

Thus in a dialogue representation structure all relevant information must be included and the flow of information among utterances must be specified. The proposed dialogue representation structure has two components: one is a set of dialogue referents and the other is a set of dialogue conditions. Each dialogue referent refers not to a single entity (for example, a person or a thing), but to a DRS that represents the content of the message conveyed by an utterance. Due to this mechanism, information obtained from an utterance is available when its subsequent utterances are processed and thus flow of information occurs among utterances. In addition, each dialogue condition is constructed after each utterance is processed and thus it is possible to recognize which information is obtained from which utterance. This type of incremental and compositional information is needed for the recovery of missing constituents. Thus a dialogue can be properly represented by the dialogue representation structure, where all relevant contextual and non-contextual information is incorporated and flow of information occurs. Based on information flow between utterances, it is possible to detect whether a dialogue is coherent or not. If a dialogue is incoherent, we cannot obtain a structure that represents the dialogue.

In the next chapter we consider how to resolve an honorific pronoun appearing in a dialogue using social status information that can be included in a dialogue representation structure.

Chapter 5

The Resolution of Honorific Pronouns

The speaker of an utterance may use an *honorific pronoun* to refer to a person whose social status is higher than that of the speaker himself and is equal to or higher than that of the addressee. There exists only one third-person honorific pronoun in Korean.¹ This means that the referent of an honorific pronoun occurring in an utterance cannot be the speaker or the addressee of that utterance. The referent of the NP to which an honorific morpheme attaches is honoured by a speaker. The referent of an honorific pronoun is also honoured by a speaker. These facts may tempt us to adopt the method of selecting the referent of the NP to which an honorific morpheme attaches as the referent of an honorific pronoun. Although this simple method is effective when a dialogue is held between two fixed persons, it is inadequate when a dialogue is held among more than two persons. This chapter shows that the use of social status information obtainable from a dialogue leads to the correct resolution of honorific pronouns.

The first section presents the system of singular personal pronouns in Korean and the properties of an honorific pronoun. The subsequent section shows the limitations of the method which depends on the surface form of an NP and the advantages of using social status information in the resolution of an honorific pronoun occurring in a dialogue. In the final section conclusions are drawn about the resolution of honorific pronouns.

5.1 Characteristics of an Honorific Pronoun

Since honorification exists in Korean, there is also an honorific pronoun. The honorific pronoun is used to refer only to a person. Thus let us look at the singular personal pronoun system, which is illustrated in (5.1).

¹Although there are two humble pronouns that induce the effect of honouring the addressee, they are first-person pronouns. Thus humble pronouns always resolve to the speaker of an utterance where they appear.

(5.1)

	Plain Form	Honorific Form	Humble Form
First Person	na, nay	-	ce, cey
Second Person	ne, ney	-	-
Third Person	ku 'he'	kupwun	-
	kunye 'she'		

Singular Personal Pronoun System²

The first-person pronoun refers to the speaker of an utterance, whereas the second-person pronoun refers to the addressee. Since the speaker cannot honour himself, there is no first-person honorific pronoun. On the other hand, when the social status of the addressee is higher than that of a speaker who wants to use a pronoun that refers to himself, the first-person humble pronoun must be used. For example, the situation where the utterance in (5.2a) can be used is different from the situation where the utterance in (5.2b) can be used.

- (5.2) a. Cey-ka i sacin-ul ccik-ess-eyo.
 I (hum)-nom this picture-acc take-past-dec (hon)
 'I took this picture.'
 (Speaker: Y, Addressee: W)
- b. Nay-ka i sacin-ul ccik-ess-e.
 I-nom this picture-acc take-past-dec
 'I took this picture.'
 (Speaker: Y, Addressee: W)

The first-person humble pronoun *cey* appears in utterance (5.2a). Consequently, the utterance can be used in a situation where the social status of the addressee *W* is higher

²The system of plural personal pronouns is very similar to this system, as shown in (a).

(a)

	Plain Form	Honorific Form	Humble Form
First Person	wuli(tul)	-	cehi(tul)
Second Person	nehi(tul)	-	-
Third Person	kutul 'they' kunyetul 'they (female)'	kupwuntul	-

than that of the speaker *Y*. To the contrary, the first-person plain (that is, nonhonorific) pronoun *na* appears in utterance (5.2b). This means that the utterance can be used in a situation where the social status of the speaker *Y* is equal to or higher than that of the addressee *W*.

In the case of the second-person pronoun and the third-person pronoun there is no humble pronoun. The reason is that the addressee and a person mentioned in an utterance cannot be in a position to show honour to others. In other words, only the speaker can show honour to others in an utterance. Although there is no second-person honorific pronoun, either, the speaker may choose to use an NP that contains the title of the addressee and an honorific morpheme to refer to the addressee (for example, if the addressee is an executive director of a company and has higher social status than the speaker, the speaker may use the NP *cenmwu-nim* 'executive director-honorific suffix' to refer to the addressee).

There is only a third-person honorific pronoun, as illustrated in (5.1). This means that the speaker and the addressee of an utterance where the honorific pronoun appears cannot be the referent of the honorific pronoun.

The referent of an honorific pronoun is always a person. In other words, an entity that is not a person cannot be the antecedent for an honorific pronoun. Let us consider the dialogue in (5.3).

- (5.3) a. kangaci-ka M-kkey kkoli-lul huntul-ess-e.
 puppy-nom dat (hon) tail-acc wag-past-dec
 'A puppy wagged his tail at M.'
 (Speaker: K, Addressee: R)
- b. Kupwun-i koki-lul cohaha-si-ni?
 he/she (hon)-nom meat-acc like-hon-int
 'Does he/she like meat?'
 (Speaker: R, Addressee: K)

In dialogue (5.3) five entities are involved: a puppy, a person named *M*, meat, a person named *K*, and a person named *R*. The last two persons are the addressee and the speaker of utterance (5.3b) where an honorific pronoun appears and thus they cannot be the referent of the honorific pronoun. Since the entity *a puppy* or *meat* does not refer to a person, it cannot be the referent of the honorific pronoun, either. Thus

only the person named *M* can be a candidate for the referent of the honorific pronoun appearing in utterance (5.3b).

Unlike the third-person nonhonorific pronoun, the honorific pronoun refers to a person irrespective of the gender of the person. Thus the honorific pronoun may resolve to an NP that refers to a person, even if information about the gender of the person is not available. As an example, let us look at the dialogue shown in (5.4).

- (5.4) a. *H-kkeyse* *selyu-lul* *pat-usi-ess-e*.
 nom (hon) document-acc receive-hon-past-dec
 ‘H received a document.’
 (Speaker: J, Addressee: P)
- b. *Kupwun-i* *ku* *selyu-lul* *ilk-usi-ess-ni?*
 he/she (hon)-nom the document-acc read-hon-past-int
 ‘Did he/she read the document?’
 (Speaker: P, Addressee: J)

Dialogue (5.4) is held between two persons. Since an honorific pronoun appearing in an utterance cannot resolve to the speaker or the addressee of that utterance, the only candidate for the referent of the honorific pronoun in (5.4b) is the person *H* who is mentioned in (5.4a). Although information about the gender of the person *H* is not provided by the subject NP *H-kkeyse* in utterance (5.4a), the honorific pronoun can resolve to that person because the honorific pronoun itself does not provide gender information. Thus information about gender does not play a role in the resolution of an honorific pronoun.

5.2 Resolving an Honorific Pronoun Based on Social Status Information

An honorific morpheme such as the honorific suffix *nim* or an honorific case marker

can attach only to an NP that refers to a person.³ The referent of the NP to which an honorific morpheme attaches is honoured by the speaker of an utterance. The referent of an honorific pronoun is also honoured by the speaker of an utterance. From these facts we may draw a hasty conclusion that an honorific pronoun always resolves to an NP to which an honorific morpheme attaches. In other words, we may be tempted to use a simple method of looking for the NP to which an honorific morpheme attaches in order to resolve an honorific pronoun occurring in a dialogue. This simple method is effective only in limited situations. As an example, let us first consider the dialogue shown in (5.5).

- (5.5) a. W-ka R-nim-ul poy-ess-ni?
 nom hon-acc meet (hum)-past-int
 'Did W meet R?'
 (Speaker: K, Addressee: H)
- b. Kupwun-un pappu-si-eyo.
 he/she (hon)-top busy-hon-dec (hon)
 'He/She is busy.'
 (Speaker: H, Addressee: K)

Four persons are involved in dialogue (5.5): *W*, *R*, *K*, and *H*. The speaker and the addressee of utterance (5.5b) where an honorific pronoun appears, cannot be the referent of that pronoun. Among the remaining two persons, *W* and *R*, only the person *R* can be the referent of the honorific pronoun since the NP referring to *R* is followed by an honorific morpheme. Thus in this case the simple method works correctly. Under the situation where a dialogue is held between two fixed persons and an honorific pronoun occurs in that dialogue, the simple method is effective.

³The utterance where an honorific morpheme attaches to an NP that does not refer to a person is infelicitous as shown in (a).

- (a) * koyangi-ka kay-nim-ul ccoch-ass-e.
 cat-nom dog-hon-acc chase-past-dec
 'A cat chased a dog.'
 (Speaker: Heechul, Addressee: Moonsoo)

In utterance (a) the honorific suffix *nim* attaches to the NP *kay*, which does not refer to a person. In order for the utterance to be felicitous the honorific suffix should not be used.

Let us now look at the dialogue shown in (5.6), where the simple method does not work correctly.

- (5.6) a. Y-ka choan-ul caksengha-yess-e.
 nom draft-acc make out-past-dec
 ‘Y made out a draft.’
 (Speaker: L, Addressee: P)

- b. M-i ku choan-ul ilk-ess-e.
 nom the draft-acc read-past-dec
 ‘M read the draft.’
 (Speaker: P, Addressee: L)

- c. S, e P-eykey selyu-lul pwuchi-ess-ni?
 dat document-acc mail-past-int
 ‘S, did you mail a document to P?’
 (Speaker: L, Addressee: S)

- d. Cey-ka ecey kupwun-ul poy-ess-eyo.
 I (hum)-nom yesterday he/she (hon)-acc meet (hum)-past-dec (hon)
 ‘I met him/her yesterday.’
 (Speaker: S, Addressee: L)

In dialogue (5.6) five persons are involved. Three persons (that is, *L*, *P*, and *S*) take part in the dialogue and the other two persons (namely, *Y* and *M*) are mentioned in the dialogue. In the dialogue, however, there is no NP to which an honorific morpheme attaches. Consequently, if we adopt the simple method, we cannot resolve the honorific pronoun appearing in utterance (5.6d), although the referent of the honorific pronoun is actually *P*. Thus just looking for an NP to which an honorific morpheme attaches does not always resolve an honorific pronoun occurring in a dialogue.

On the other hand, if we use the information about the social status of the individuals involved in a dialogue, we can resolve an honorific pronoun correctly. The social status of the referent of an honorific pronoun is higher than that of the speaker and is equal to or higher than that of the addressee in the utterance where it occurs. Thus resolving an honorific pronoun in an utterance amounts to finding a

referent whose social status is higher than that of the speaker of the utterance and is equal to or higher than that of the addressee of the utterance, using the information about social status obtained from the dialogue where the utterance occurs.

Let us first consider how to resolve the honorific pronoun occurring in dialogue (5.5), using social status information. After the utterance in (5.5a) is processed, the information about social status illustrated in (5.7) is obtained.⁴

(5.7) $K \geq W, R > K, K \geq H$

Similarly, when the utterance in (5.5b) is processed, the social status information shown in (5.8) is obtained.⁵

(5.8) $? > H, ? \geq K, H \neq K$

The task of resolving the honorific pronoun occurring in utterance (5.5b) amounts to the task of finding the referent that satisfies the conditions, $? > H$ and $? \geq K$ (namely, the social status of the unidentified referent is higher than that of H and is equal to or higher than that of K), based on other pieces of social status information contained in (5.7) and (5.8). The information in (5.7) and (5.8) can be further collapsed into (5.9) since $K > H$ is inferred from $K \geq H$ and $H \neq K$.

(5.9) $K \geq W, R > K, K > H$

We can infer $R > H$ from $R > K$ and $K > H$ appearing in (5.9). Since $R > H$ and $R > K$ are obtained from (5.9), the referent that satisfies the conditions, $? > H$ and $? \geq K$, is R . It follows from this that the referent of the honorific pronoun occurring in utterance (5.5b) is the person R .

Let us now consider how to resolve the honorific pronoun occurring in dialogue (5.6), where more than two dialogue participants appear. After the utterances in (5.6a) and (5.6b) are processed, the pieces of social status information shown in (5.10a) and (5.10b) are obtained, respectively.

⁴For the detailed explanation of how to extract social status information from an utterance, refer to Section 2.3 of Chapter 2.

⁵Since we don't know yet the referent of the honorific pronoun occurring in utterance (5.5b), it is represented by the question mark '?'.

- (5.10) a. $L \geq Y, L \geq P$
 b. $P \geq M, P \geq L$

In utterance (5.6c) a subject NP is missing. Since a vocative NP appears in the utterance, the referent of the missing subject NP is the addressee.⁶ Thus the social status information shown in (5.11) is obtained.

- (5.11) $L \geq P, L \geq S$

In utterance (5.6d) a humble first-person pronoun and an honorific pronoun are used. The use of a humble first-person pronoun means that the social status of the addressee is higher than that of the speaker. Thus the social status information illustrated in (5.12) is obtained.

- (5.12) $L > S, ? > S, ? \geq L$

Resolving the honorific pronoun occurring in utterance (5.6d) amounts to finding the referent that satisfies the conditions, $? > S$ and $? \geq L$. Since $L = P$ is inferred from $L \geq P$ in (5.10a) and $P \geq L$ in (5.10b), the information in (5.10) is collapsed into (5.13).

- (5.13) $L \geq Y, P \geq M, L = P$

If a more informative condition is available, the less informative one is discarded. $L = P$ in (5.13) is more informative than $L \geq P$ in (5.11) and $L > S$ in (5.12) is more informative than $L \geq S$ in (5.11). Thus when we combine the information in (5.13) with the information in (5.11) and (5.12), we get the result shown in (5.14).

- (5.14) $L \geq Y, P \geq M, L = P, L > S$.

The information in (5.14) shows the relative order of the social status of the people involved in dialogue (5.6). At first sight, it seems that L satisfies the conditions, $? > S$ and $? \geq L$ since $L > S$ appears in (5.14). An honorific pronoun, however, is a third-person pronoun and thus neither S (the speaker of utterance (5.6d)) nor L (the

⁶The method for recovering missing constituents in an utterance is presented in Chapter 6.

addressee of utterance (5.6d)) can be its referent. From $L=P$ and $L>S$ in (5.14), $P>S$ is inferred. Since we get $P>S$ and $L=P$ from (5.14), the referent that satisfies the conditions, $?>S$ and $? \geq L$ is P . Consequently, the referent of the honorific pronoun occurring in utterance (5.6d) is the person P . When a dialogue is held, a person may not be honoured in one utterance, but the same person may be honoured in another utterance if the two utterances are not uttered by the same speaker. For example, in utterance (5.6c) the person P is not honoured by the speaker L (since the social status of L is equal to that of P), whereas in utterance (5.6d) the same person is honoured by the speaker S (since the social status of P is higher than that of S and is equal to that of the addressee L). For this reason, the simple method of looking for the NP to which an honorific morpheme attaches in order to resolve an honorific pronoun in a dialogue does not always work correctly.

The use of social status information in the resolution of an honorific pronoun also enables us to select the right referent of the pronoun among the seemingly possible candidates for the referent of the pronoun. As an example, let us consider the dialogue shown in (5.15).

- (5.15) a. C-nim-i H-nim-kkey chengsacin-ul ponaytuli-si-ess-e.
 hon-nom hon-dat (hon) blueprint-acc send (hum)-hon-past-dec
 ‘C sent a blueprint to H.’
 (Speaker: M, Addressee: S)

- b. K-nim-i H-nim-ul poy-si-ess-e.
 hon-nom hon-acc meet (hum)-hon-past-dec
 ‘K met H.’
 (Speaker: S, Addressee: M)

- c. e C-nim-eykey choan-ul poyecwu-si-ess-e.
 hon-dat draft-acc show-hon-past-dec
 ‘He/She showed a draft to C.’
 (Speaker: M, Addressee: S)

- d. kupwun-kkeyse chengsacin-ul kuli-si-ess-ni?
 he/she (hon)-nom (hon) blueprint-acc draw-hon-past-int

‘Did he/she draw the blueprint?’

(Speaker: K, Addressee: M)

An honorific pronoun occurs in utterance (5.15d). If we just pay attention to the NP to which an honorific morpheme attaches, there are three possible referents of the honorific pronoun: *C*, *H*, and *K*. Not all of them, however, can be the pronoun’s referent. Let us find out the right referent of the honorific pronoun among these three candidates, using social status information. When utterance (5.15a) is processed, the social status information shown in (5.16) is obtained.

(5.16) $H > C$, $C > M$, $M \geq S$

Likewise, when utterance (5.15b) is processed, the social status information illustrated in (5.17) is obtained.

(5.17) $H > K$, $K > S$, $S \geq M$

In utterance (5.15c) the referent of the missing subject NP is the same as that of the subject NP of its immediately preceding utterance (that is, *K*). Thus the social status information shown in (5.18) is obtained from utterance (5.15c).

(5.18) $K \geq C$, $C > M$, $M \geq S$

Finally, when we process utterance (5.15d) where the honorific pronoun occurs, we obtain the social status information illustrated in (5.19).

(5.19) $? > K$, $? \geq M$, $K \geq M$

Thus the resolution of the honorific pronoun in utterance (5.15d) amounts to a search for the referent that satisfies the conditions, $? > K$ and $? \geq M$. When we look at the information in (5.17), $H > K$ exists there. We can infer $H > M$ from $H > K$, $K > S$, and $S \geq M$ appearing in (5.17). Consequently, $H > K$ and $H > M$ are obtained from (5.17). Thus *H* is the referent that satisfies the conditions, $? > K$ and $? \geq M$. It follows from this that the honorific pronoun in utterance (5.15d) resolves to the person *H*. Since $K \geq C$ is available as shown in (5.18), the person *C* cannot be the referent of the honorific

pronoun. In addition, since a condition such as $K > K$ is not possible in any context, K cannot be the pronoun's referent, either. This accurate selection of the referent of the honorific pronoun can be made only if social status information is used. Therefore, we must use the social status information that can be obtained from a dialogue in order to correctly resolve an honorific pronoun occurring in that dialogue.

When multiple honorific pronouns occur in a dialogue, each honorific pronoun can resolve to a relevant person if social status information obtained from the dialogue is enough to lead to such resolution. Otherwise, our method of using social status information is helpful in narrowing down candidates for the referents of those honorific pronouns. The same explanation applies to the case where more than one honorific pronoun appears in a single utterance, though this rarely occurs in Korean dialogue.

5.3 Summary and Discussion

An honorific pronoun in Korean is a third-person pronoun and refers only to a person. It follows from this that the referent of an honorific pronoun occurring in an utterance cannot be the speaker or the addressee of that utterance. The simple method of identifying the referent of an honorific pronoun with the referent of the NP to which an honorific morpheme attaches does not always work correctly. If a dialogue is held between only two fixed persons, the simple method is effective. The method, however, cannot always correctly resolve an honorific pronoun occurring in a dialogue which is held among more than two persons. In such a dialogue an honorific pronoun may occur in an utterance even if no co-referring NP to which an honorific morpheme attaches appears in previous utterances. In this case the simple method wrongly concludes that the honorific pronoun cannot be resolved, although the pronoun's referent actually appears in the dialogue. In addition, the simple method regards all the referents of the NPs to which an honorific morpheme attaches as potential referents of an honorific pronoun, although some of them cannot be its referent given the particular situation in which the dialogue is held.

On the other hand, if we use social status information that is obtained from utterances occurring in a dialogue, we can overcome the limitations of the simple method and deal with the resolution of an honorific pronoun correctly. The occurrence of an honorific pronoun in an utterance indicates that the social status of the pronoun's referent is higher than that of the speaker and is equal to or higher than that of the

addressee of the utterance. Consequently, the resolution of an honorific pronoun occurring in a dialogue amounts to a search for the referent that satisfies the condition about social status imposed on the honorific pronoun, based on social status information obtained from the dialogue. By using social status information, we can resolve an honorific pronoun even when there seems to be no candidate for the referent of the pronoun and can also select the correct referent of the pronoun when there is seemingly more than one candidate. Thus the use of social status information is indispensable to the resolution of an honorific pronoun occurring in a dialogue.

In the next chapter we discuss how to recover missing constituents in an utterance of a dialogue, using the structural and contextual information related to the utterance.

Chapter 6

The Recovery of Missing Constituents

In everyday Korean dialogue, constituents are frequently omitted. Unlike English, a whole constituent is omitted rather than use a pronoun. In addition, unlike so-called pro-drop languages such as Italian and Spanish, in which the inflection that occurs on the verb indicates the type of a missing pronoun in an utterance, there is no such verbal inflection in Korean. In order to recover missing constituents in Korean dialogue, we argue that it is necessary to make use of the social status information obtained from a dialogue as well as information about the utterance type, the structure of an utterance, the preceding utterance(s), and the dialogue participants (that is, the speaker and the addressee of each utterance occurring in a dialogue).

In section 6.1 the types of constituents which may be omitted and the referents of those missing constituents are discussed. On the basis of the corpora of real spoken dialogues, section 6.2 shows the characteristics of dialogue. In section 6.3 we first present the framework of centering theory, which is used to resolve anaphoric expressions in discourse, and then discuss whether the theory can be applied to the recovery of omitted constituents in dialogue. Section 6.4 shows the algorithm and the decision chart of our pragmatic approach for the recovery of missing constituents. The final section draws the conclusion that structural information and contextual information must be used in recovering missing constituents.

6.1 Types of Omission and Recovery

Constituents of an utterance such as the subject NP and the object NP (namely, the direct object NP or the indirect object NP) are frequently omitted in Korean dialogue when they can be recovered from the context of the dialogue. Let us look at the types of omitting constituents in dialogue and the referents of those omitted constituents.

First, a constituent can be omitted in a dialogue-initial utterance. In this case there is no previous utterance and thus we have to rely on the information obtainable from the utterance itself in order to recover a missing constituent. As an example let us look

at the utterance shown in (6.1), on the assumption that it occurs initially in a dialogue.

- (6.1) ϵ ecey yenghwa-lul po-ass-ni?
 yesterday movie-acc watch-past-int
 ‘Did *you* watch a movie yesterday?’
 (Speaker: Y, Addressee: K)

In utterance (6.1) the subject NP is missing and the interrogative verbal ending *ni* is used. In this case the missing subject NP of the utterance refers to the addressee of the utterance. On the other hand, if a declarative verbal ending instead of an interrogative verbal ending is used as shown in utterance (6.2), the missing subject NP refers to the speaker of the utterance, not to the addressee of the utterance.

- (6.2) ϵ ecey yenghwa-lul po-ass-e.
 yesterday movie-acc watch-past-dec
 ‘I watched a movie yesterday.’
 (Speaker: Y, Addressee: K)

The only difference between utterance (6.1) and utterance (6.2) is that the interrogative verbal ending *ni* is used in the former utterance, whereas the declarative verbal ending *e* is used in the latter utterance. The same result is obtained when an object NP is omitted in a dialogue-initial utterance.

- (6.3) W-kkeyse ϵ chengsacin-ul poyecwu-si-ess-supnikka?
 nom (hon) blueprint-acc show-hon-past-int (hon)
 ‘Did W show a blueprint to *you*?’
 (Speaker: P, Addressee: L)

In utterance (6.3) an indirect object NP is missing and the honorific interrogative verbal ending *supnikka* is used. In this case the referent of the missing indirect object NP is the addressee of the utterance.

- (6.4) W-kkeyse ϵ chengsacin-ul poyecwu-si-ess-supnita.
 nom (hon) blueprint-acc show-hon-past-dec (hon)

‘W showed a blueprint to *me*.’

(Speaker: P, Addressee: L)

Utterance (6.4) is the same as utterance (6.3) except that the honorific declarative verbal ending *supnita* is used. Due to this difference, the referent of the missing indirect object NP in utterance (6.4) is the speaker of the utterance, not the addressee of the utterance. In general, the referent of a missing NP in a dialogue-initial utterance is the addressee of the utterance if an interrogative verbal ending is used in the utterance, whereas it is the speaker of the utterance if a declarative verbal ending is used in the utterance. Thus in the recovery of a missing NP in a dialogue-initial utterance, information about the verbal ending that is used plays a decisive role.

Second, in a vocative utterance a subject NP can be omitted. A vocative NP occurs in the vocative utterance and the referent of the vocative NP is always the addressee of the utterance.

(6.5) Youngho-ya, ^e phyenlam-ul pat-ass-ni?
 voc handbook-acc receive-past-int

‘Youngho, did *you* receive a handbook?’

(Speaker: Soochul, Addressee: Youngho)

In utterance (6.5) the vocative NP *Youngho-ya* contains a vocative case marker *ya* and its referent is the addressee of the utterance. When a subject NP is missing in a vocative utterance where an interrogative verbal ending is used as shown in (6.5), the referent of the missing subject NP is the referent of a vocative NP (that is, the addressee of the utterance). This holds regardless of whether a vocative utterance occurs non-initially or not in a dialogue. On the other hand, if a declarative verbal ending is used in a vocative utterance which occurs initially in a dialogue, as illustrated in (6.6), the referent of a missing subject NP is the speaker of the utterance, not the referent of a vocative NP.

(6.6) Youngho-ya, ^e phyenlam-ul pat-ass-e.
 voc handbook-acc receive-past-dec

‘Youngho, *I* received a handbook.’

(Speaker: Soochul, Addressee: Youngho)

The referent of the missing subject NP in utterance (6.6) is the speaker *Soochul*. When utterance (6.6) does not occur initially in a dialogue, however, the referent of the missing subject NP can be found by consulting its preceding utterance(s). Thus the referent of a missing subject NP in a vocative utterance is the referent of a vocative NP occurring in that utterance when an interrogative verbal ending is used, whereas it is the speaker of the utterance when the utterance occurs initially in a dialogue and a declarative verbal ending is used. In other cases the recovery of a missing subject NP in a vocative utterance depends on the information coming from its preceding utterance(s).

Third, when a verb of an utterance is the same as that of its immediately preceding utterance, the number of constituents that can be omitted depends on the type of the verb. If the verb of an utterance is an intransitive verb, only one constituent (that is, the subject NP) can be omitted in the utterance, as shown in dialogue (6.7).

- (6.7) a. P-kkeyse naka-si-ess-ni?
 nom (hon) go out-hon-past-int
 ‘Did P go out?’
 (Speaker: J, Addressee: R)
- b. e naka-si-ess-e.
 go out-hon-past-dec
 ‘He went out.’
 (Speaker: R, Addressee: J)

In utterance (6.7b) the subject NP is omitted and the verb of the utterance is the same as that of its immediately preceding utterance, i.e., utterance (6.7a). In this case the referent of the missing subject NP in utterance (6.7b) is the same as that of the subject NP in (6.7a). If the verb of an utterance is a transitive verb, maximally two constituents (namely, the subject NP and the object NP) can be omitted in the utterance, as illustrated in dialogue (6.8).

- (6.8) a. H-ka choan-ul caksengha-yess-ni?
 nom draft-acc make out-past-int
 ‘Did H make out a draft?’
 (Speaker: Y, Addressee: K)

- b. e e caksengha-yess-e.
 make out-past-dec
 ‘He made it out.’
 (Speaker: K, Addressee: Y)

In utterance (6.8b) two constituents are missing and the verb of the utterance is the same as that of its immediately preceding utterance, i.e., utterance (6.8a). In this case the referent of the missing subject NP and the referent of the missing object NP in utterance (6.8b) are the same as that of the subject NP and that of the object NP in utterance (6.8a), respectively. Even when only one constituent is omitted in an utterance where a transitive verb is used and the same transitive verb is used in its immediately preceding utterance, the referent of the missing constituent is the same as that of its corresponding one in the immediately preceding utterance, as shown in dialogue (6.9).

- (6.9) a. H-ka choan-ul caksengha-yess-ni?
 nom draft-acc make out-past-int
 ‘Did H make out a draft?’
 (Speaker: Y, Addressee: K)
- b. W-ka e caksengha-yess-e.
 nom make out-past-dec
 ‘W made it out.’
 (Speaker: K, Addressee: Y)

The referent of the missing object NP in utterance (6.9b) is the same as that of the object NP in utterance (6.9a). If the main verb of an utterance is a ditransitive verb, maximally three constituents (that is, the subject NP, the indirect object NP, and the direct object NP) can be omitted, as illustrated in dialogue (6.10).

- (6.10) a. L-kkeyse Y-eykey selyu-lul cwu-si-ess-eyo?
 nom (hon) dat document-acc give-hon-past-int (hon)
 ‘Did L give a document to Y?’
 (Speaker: M, Addressee: S)

- b. \emptyset \emptyset \emptyset cwu-si-ess-e.
 give-hon-past-dec
 ‘He gave it to him.’
 (Speaker: S, Addressee: M)

In utterance (6.10b) all three arguments (that is, the subject NP, the indirect object NP, and the direct object NP) of the ditransitive verb *cwu* ‘give’ are missing and the same verb is used in its immediately preceding utterance, namely, utterance (6.10a). In this situation the referents of the three missing constituents in utterance (6.10b) are the same as those of their corresponding constituents in utterance (6.10a), respectively. Even when just one constituent is missing or two constituents are missing in an utterance where a ditransitive verb is used and the same ditransitive verb is used in its immediately preceding utterance, the referent of the missing constituent is the same as that of its corresponding one in the preceding utterance, as shown in dialogue (6.11).

- (6.11) a. L-kkeyse Y-eykey selyu-lul cwu-si-ess-eyo?
 nom (hon) dat document-acc give-hon-past-int (hon)
 ‘Did L give a document to Y?’
 (Speaker: M, Addressee: S)

- b. \emptyset P-eykey \emptyset cwu-si-ess-e.
 dat give-hon-past-dec
 ‘He gave it to P.’
 (Speaker: S, Addressee: M)

In utterance (6.11b) the subject NP and the direct object NP are omitted and the verb of the utterance is the same as that of its immediately preceding utterance, namely, utterance (6.11a). In this case the referent of the missing subject NP and the referent of the missing direct object NP in utterance (6.11b) are the same as that of the subject NP and that of the direct object NP in utterance (6.11a), respectively. Therefore, when a constituent is missing in an utterance whose verb is the same as that of its immediately preceding utterance, the referent of the missing constituent is the same as that of its corresponding constituent in the immediately preceding utterance irrespective of the type of the verb used (namely, irrespective of whether it is an intransitive verb, a transitive verb or a ditransitive verb).

Finally, a constituent may be omitted in a non-initial utterance where a vocative NP does not occur and whose verb is different from that of its immediately preceding utterance. In this case the recovery of the missing constituent depends on the information obtained from its preceding utterance(s). When only one NP is missing in such an utterance, the referent of the missing NP is the referent of one of the constituents in (6.12) that occurs in its immediately preceding utterance.

(6.12) the subject NP; the indirect object NP; the direct object NP

The constituents in (6.12) are shown in the order of preference.¹ If the subject NP of the immediately preceding utterance cannot be the referent of the missing NP due to the incompatibility in social status information, the indirect object NP is chosen as the next candidate for the referent of the missing NP. If the indirect object NP is also found to be ineligible, the direct object NP is finally checked. When even the direct object NP is found to be ineligible, the missing NP cannot be recovered. As an example, let us consider the dialogue shown in (6.13).

- (6.13) a. S-ka R-kkey chengsacin-ul pwuchi-ess-e.
 nom dat (hon) blueprint-acc mail-past-dec
 ‘S mailed a blueprint to R.’
 (Speaker: K, Addressee: P)
- b. e choan-ul caksengha-si-ess-ni?
 draft-acc make out-hon-past-int
 ‘Did ~~he~~ make out a draft?’
 (Speaker: P, Addressee: K)

In utterance (6.13b) no vocative NP occurs and the verb of the utterance is different from that of its preceding utterance. In accordance with the order of preference illustrated in (6.12), the referent of the missing NP in utterance (6.13b) is assumed to be that of the subject NP in utterance (6.13a). This assumption, however, gives rise to the incompatibility in social status information about the individuals involved in dialogue (6.13). On the assumption that the referent of the missing NP in (6.13b) is

¹Grosz, Joshi, and Weinstein (1995) observe that the order of salience on constituents appearing in English sentences is: Subject > Object(s) > Others.

that of the subject NP in (6.13a), we obtain the information about social status shown in (6.14).

- (6.14) a. $K \geq S$, $R > K$, $K \geq P$
 b. $S > P$, $S \geq K$, $P \geq K$

While the information in (6.14a) is obtained from utterance (6.13a), the information in (6.14b) is obtained from utterance (6.13b). The relation $K=S$ is inferred from $K \geq S$ and $S \geq K$. Likewise, the relation $K=P$ is inferred from $K \geq P$ and $P \geq K$. Accordingly, the information in (6.14) can be collapsed into (6.15).

- (6.15) a. $R > K$
 b. $S > P$, $K=S$, $K=P$

A close look at the information in (6.15) reveals that the relation $S > P$ is incompatible with the relation $S=P$, which can be inferred from $K=S$ and $K=P$. It follows from this incompatibility that the referent of the missing NP in (6.13b) is not that of the subject NP in (6.13a). Thus we have to check the next candidate for the referent of the missing NP (namely, the referent of the indirect object NP *R-key* occurring in (6.13a)). In this case the information illustrated in (6.16) is obtained.

- (6.16) a. $K \geq S$, $R > K$
 b. $R > P$, $K=P$

As shown in (6.16) no incompatibility exists. Consequently, the referent of the missing subject NP in (6.13b) is that of the indirect object NP occurring in (6.13a).

On the other hand, if two constituents (that is, a subject NP and an object NP) are omitted in a non-initial utterance where a vocative NP does not occur and whose verb is different from that of its immediately preceding utterance, the referent of the missing subject NP is the referent of one of the constituents in (6.12) that occurs in its second preceding utterance, whereas the referent of the missing object NP is the referent of one of the constituents in (6.12) that occurs in its immediately preceding (i.e., its first preceding) utterance. As in the case where only one NP is omitted, the constituents shown in (6.12) are checked in the order of preference until an appropriate constituent is selected as the referent of a missing NP. As an example, let us look at the dialogue

illustrated in (6.17).

- (6.17) a. Y-kkeyse P-eykey tongcen-ul poyecwu-si-ess-eyo.
 nom (hon) dat coin-acc show-hon-past-dec (hon)
 ‘Y showed a coin to P.’
 (Speaker: H, Addressee: W)

- b. kinyem tongcen-i ecey nawass-e.
 commemoration coin-nom yesterday came-dec
 ‘A commemorative coin was issued yesterday.’
 (Speaker: W, Addressee: H)

- c. e e pelsse sa-si-ess-eyo.
 already buy-hon-past-dec (hon)
 ‘He already bought it.’
 (Speaker: H, Addressee: W)

In utterance (6.17c) both the subject NP and the object NP are missing. To recover the missing subject NP in utterance (6.17c), the subject NP occurring in its second preceding utterance, that is, utterance (6.17a), is checked. If we assume that the referent of the missing subject NP in (6.17c) is the referent of the subject NP in (6.17a), we can get the information about social status illustrated in (6.18).

- (6.18) a. $Y > H$, $Y \geq W$, $H \geq P$, $H \neq W$
 b. $W \geq H$
 c. $Y > H$, $Y \geq W$, $H \neq W$

The pieces of information in (6.18a)-(6.18c) are obtained from the utterances in (6.17a)-(6.17c), respectively. As shown in (6.18) no incompatibility arises. Thus the referent of the missing subject NP in (6.17c) is the same as that of the subject NP in (6.17a). Since the most preferred candidate (namely, the subject NP) is found to be the referent of the missing subject NP, we do not need to check other less preferred candidates (that is, the indirect object NP and the direct object NP). On the other hand, to recover the missing object NP in utterance (6.17c), we check the subject NP occurring in its immediately preceding utterance, i.e., utterance (6.17b). The subject

NP in (6.17b) does not refer to a person. Since social status information is related only to people, it is not necessary to check whether incompatibility arises in the social status information as the result of selecting the subject NP in (6.17b) as the referent of the missing object NP in (6.17c). Consequently, the referent of the missing object NP in utterance (6.17c) is the same as that of the subject NP in its immediately preceding utterance.

6.2 Real Spoken Dialogue

In order to investigate various linguistic phenomena, including the claims made above, we collected a corpus of naturally occurring spoken dialogues and transcribed them into written form.² Three spoken dialogues were collected: a dialogue about learning a foreign language, which was held over the phone (hereafter, dialogue L), a dialogue about memorable travels, which was held in a broadcasting studio (hereafter, dialogue T), and a dialogue between family members in a soap opera (hereafter, dialogue S). These dialogues are classified according to whether they are held spontaneously (that is, *impromptu*) and whether they are held face-to-face, as shown in (6.19).

(6.19)

	Dialogue L	Dialogue T	Dialogue S
Spontaneous?	yes	yes	no
Face-to-Face?	no	yes	yes

Since dialogue L is held over the phone, the speaker and the addressee cannot see each other. Thus dialogue L is not a face-to-face dialogue. The dialogue in a soap opera is presumably based on a script that is already written and thus it is not a spontaneous dialogue. Let us now look at the characteristics of dialogue.

First, in everyday life, dialogue is held between people. Since the phenomenon of honorification is concerned with people, it frequently occurs in dialogue.

Second, the length of sentences in a face-to-face dialogue tends to be longer than that of sentences in a non-face-to-face dialogue. This tendency may be attributed to the fact that in a face-to-face dialogue the speaker can see non-verbal acknowledgment or understanding (for example, gestures and facial expressions) by the addressee. This additional factor makes it easier for rather long sentences to be spoken and understood.

²The transcripts of spoken dialogues appear in Appendix A.

Our corpus of real spoken dialogues supports the tendency, as illustrated in (6.20).

(6.20)

	Non-Face-to-Face Dialogue	Face-to-Face Dialogue	
	Dialogue L	Dialogue T	Dialogue S
Total Sentences	81	82	128
Total Words	365	553	632
Average Number of Words per Sentence	$4.51 (= \frac{365}{81})$	$6.74 (= \frac{553}{82})$	$4.94 (= \frac{632}{128})$

The average number of words used in sentences that occur in a face-to-face dialogue is greater than that for sentences that occur in a non-face-to-face dialogue. This means that sentences in a face-to-face dialogue are usually longer than those in a non-face-to-face dialogue.

Third, turn-taking in a spontaneous dialogue tends to be smoother than that in a non-spontaneous dialogue. By smooth turn-taking we mean that a certain participant in a dialogue does not monopolize the dialogue by speaking too long in his turns.³ This tendency may be ascribed to the fact that a non-spontaneous dialogue such as a dialogue in a soap opera focuses on a story rather than the way in which a dialogue is held. Our corpus shows the tendency, as illustrated in (6.21), although in general we remain cautious of drawing firm conclusions from such a small sample.

³For a discussion about types of turns appearing in map task dialogues, which are task-oriented, refer to Carletta 1992.

(6.21)

		Spontaneous Dialogue		Non-spontaneous Dialogue
		Dialogue L	Dialogue T	Dialogue S
Total Turns		64	57	67
P e r c e n t a g e	One Sentence	78.1% (= $\frac{50}{64}$)	61.4% (= $\frac{35}{57}$)	47.8% (= $\frac{32}{67}$)
	Two Sentences	18.8% (= $\frac{12}{64}$)	33.4% (= $\frac{19}{57}$)	29.8% (= $\frac{20}{67}$)
	More than Two Sentences	3.1% (= $\frac{2}{64}$)	5.2% (= $\frac{3}{57}$)	22.4% (= $\frac{15}{67}$)
Median of Number of Sentences per Turn		2	2.5	4

As shown in (6.21), in a spontaneous dialogue more than 94% of turns contain only one sentence or two sentences, and the median of the number of sentences occurring in each turn is far less than 3. On the other hand, in a non-spontaneous dialogue more than 22% of turns contain at least three sentences, and the median of the number of sentences occurring in each turn is 4. This means that more sentences tend to be spoken in the turns of a non-spontaneous dialogue than in those of a spontaneous dialogue. In other words, the participants in a non-spontaneous dialogue tend to speak longer in their turns than those in a spontaneous dialogue. Thus turn-taking occurs more smoothly in a spontaneous dialogue than in a non-spontaneous dialogue.

Fourth, constituents are frequently omitted in an utterance if they can be recovered by the context of the utterance. Even in the initial utterance of a dialogue, constituents may be missing.

Finally, vocative NPs frequently occur in dialogue. When a vocative NP is used in an utterance, the attention of the utterance's speaker shifts to the referent of the vocative NP and that referent becomes the speaker of the subsequent utterance (that is, turn-taking occurs).

6.3 Centering Theory

Many works used the key idea of centering theory that an entity which gets the focus of attention in an utterance of a discourse plays an important role in the interpretation

of anaphora (for example, for pronoun resolution (Brennan, Friedman, and Pollard 1987; Grosz, Joshi, and Weinstein 1995), for the resolution of zero pronouns in Japanese discourse (Walker, Iida, and Cote 1994), for the generation of zero pronouns in Chinese discourse (Yeh and Mellish 1994), for the resolution of definite NPs (Grosz 1977), for reference resolution in a cookery recipe (How 1993), and for the resolution of both pronouns and definite NPs (Sidner 1983)). Let us first look at the framework of centering theory and then consider whether it can be applied to the recovery of missing constituents in Korean dialogue.

6.3.1 Framework

In centering theory (Brennan, Friedman, and Pollard 1987; Walker, Iida, and Cote 1994; Grosz, Joshi, and Weinstein 1995) the postulations appearing in (6.22) are made.

- (6.22) a. A set of discourse entities called *forward-looking centers*, C_f , is associated with each utterance in a discourse segment. The elements of the set C_f are ranked according to discourse salience.⁴
- b. The *backward-looking center* of utterance U_n , $C_b(U_n)$, is the most highly ranked element of the set C_f of its previous utterance U_{n-1} , $C_f(U_{n-1})$.

With regard to a transition relation between two adjacent utterances, three types of center transitions are defined, as illustrated in (6.23).

- (6.23) a. Continuation: $C_b(U_n) = C_b(U_{n+1})$, and $C_b(U_{n+1})$ is the most highly ranked element of $C_f(U_{n+1})$.
- b. Retention: $C_b(U_n) = C_b(U_{n+1})$, but $C_b(U_{n+1})$ is not the most highly ranked element of $C_f(U_{n+1})$.
- c. Shift: $C_b(U_n) \neq C_b(U_{n+1})$.

⁴In English the order of salience on the elements of C_f , which is generally determined by a grammatical role, is: Subject > Object(s) > Others (for example, prepositional phrases) (Grosz, Joshi, and Weinstein 1995), as mentioned earlier.

Based on the notions specified in (6.22) and (6.23), centering theory claims the rules shown in (6.24) and the constraints shown in (6.25).

(6.24) Rules:

- a. If some element of $C_f(U_n)$ is realized as a pronoun in utterance U_{n+1} , then $C_b(U_n)$ also must be realized as a pronoun in that utterance.
- b. There is a preference among types of transitions: *continuation* is preferred to *retention* and *retention* is preferred to *shift*.

(6.25) Constraints:

- a. Each utterance has precisely one backward-looking center, C_b .
- b. Every element of $C_f(U_n)$ must be realized in utterance U_n .
- c. $C_b(U_n)$ must be realized in utterance U_n .

Let us now look at how centering theory works in the resolution of a pronoun, using a discourse appearing in (6.26).

(6.26) a. Nancy went to a bookstore yesterday.

$C_b = ?$, $C_f = \{\text{Nancy, bookstore}\}$

b. She wanted to buy a book about gardening.

$C_b = \text{Nancy}$, $C_f = \{\text{Nancy, book about gardening}\}$

c. She met Emily there.

$C_b = \text{Nancy}$, $C_f = \{\text{Nancy, Emily}\}$ (Continuation occurs)

d. Emily recommended her to buy an anthology.

$C_b = \text{Nancy}$, $C_f = \{\text{Emily, Nancy, anthology}\}$ (Retention occurs)

e. She likes sonnets.

C_b = Emily, C_f = {Emily, sonnets} (Shift occurs)

f. She recited a sonnet to her.

C_b = Emily, C_f = {Emily, sonnet, Nancy} (Continuation occurs)

Utterance (6.26a) is the initial utterance of a discourse and thus its C_b cannot be specified. The C_b of utterance (6.26b) is *Nancy* since the discourse entity is the most highly ranked element of the set C_f of its previous utterance. The C_b of an utterance is the entity that the utterance most centrally concerns. Thus the referent of the pronoun in utterance (6.26b) is *Nancy*. In utterance (6.26c) its C_b is the same as the C_b of its previous utterance, that is, utterance (6.26b) and is also the most highly ranked element of its C_f. So the type of transition between these two utterances is *continuation*. Consequently, *Nancy* continues to be the referent of the pronoun in utterance (6.26c). Although the C_b of utterance (6.26d) is the same as that of its previous utterance, it is not the most highly ranked element of its C_f. As a result of this, the transition type *retention* occurs. The referent of the pronoun in utterance (6.26d) is still *Nancy* since she is still the C_b of the utterance. The C_b of utterance (6.26e) is different from that of its previous utterance and thus a shift of a backward-looking center occurs between the two utterances. So the referent of the pronoun in utterance (6.26e) is *Emily* since she is the C_b of the utterance. Finally, in utterance (6.26f) two pronouns occur. By the rule in (6.24b), a *continuation* of a backward-looking center is preferred to a *shift* of that center. If utterance (6.26f) is interpreted as 'Nancy recited a sonnet to Emily', the transition type *shift* occurs, whereas if it is interpreted as 'Emily recited a sonnet to Nancy', the transition type *continuation* occurs. Thus the preferred interpretation is the latter one. It follows from this that in utterance (6.26f) the referent of the first pronoun is *Emily* and the referent of the second pronoun is *Nancy*.

Therefore, in centering theory, when only one pronoun occurs in an utterance, the referent of the pronoun is the C_b of the utterance. If multiple pronouns occur in an utterance, the task of resolving those pronouns is carried out based on the rules stated in (6.24).

6.3.2 Inadequacy to the Recovery of Constituents

As discussed in section 6.3.1, for the resolution of a pronoun, centering theory uses the idea that the most focused entity of an utterance (namely, the most highly ranked element of the set *Cf* of an utterance) is most likely to be referred to by a pronoun in its subsequent utterance. Although the theory can resolve pronouns occurring in discourse effectively, it cannot be straightforwardly applied to the recovery of missing constituents in dialogue for the following reasons.

First, the theory does not consider the speaker and the addressee of an utterance. To recover missing constituents in a dialogue, however, these dialogue participants must be taken into account. For example, the referent of a missing constituent in a declarative utterance which occurs initially in a dialogue is the speaker of the utterance.

Second, even if we incorporate the information about the speaker and the addressee of an utterance in the theory, we have the problem of how to rank the salience order of entities such as the speaker and the addressee, and other entities that are mentioned in an utterance in order to create the set *Cf* of the utterance. As an example, let us look at the utterance shown in (6.27).

- (6.27) H-ka R-kkey choan-ul tuli-ess-ni?
 nom dat (hon) draft-acc give (hum)-past-int
 'Did H give a draft to R?'
 (Speaker: K, Addressee: W)

In utterance (6.27) five entities are involved: *H*, *R*, *choan*, *K*, and *W*. The first three entities are mentioned in the utterance and thus they can be ranked according to their salience (that is, $H > R > choan$).⁵ With regard to the speaker *K* and the addressee *W*, however, there is no definite way to rank their salience since they do not appear in the utterance (namely, they do not play any grammatical role in the utterance). In other words, we cannot know how to rank the order of salience among the entities such as the speaker, the addressee, the subject, the indirect object, and the direct object of the

⁵We take the order of salience in Korean to be as follows: Subject > Indirect Object > Direct Object > Others.

utterance. This means that we cannot get an appropriate Cr of the utterance.⁶

Third, the theory cannot recover a missing constituent in a dialogue-initial utterance. If we adopt the theory, the referent of the missing constituent in the initial utterance is regarded as the Cb of that initial utterance. Due to the notion of Cb stated in (6.22b), however, the initial utterance cannot have a Cb since its previous utterance does not exist. For example, if the utterance shown in (6.28) occurs initially in a dialogue, the missing constituent in the utterance cannot be recovered by the theory since the Cb of that utterance is not available.

- (6.28) e ecey P-eykey sopho-lul ponay-ss-e.
 yesterday dat parcel-acc send-past-dec
 ‘I sent a parcel to P yesterday.’
 (Speaker: Y, Addressee: M)

Finally, although the theory may recover a missing constituent in an utterance where a vocative NP occurs (this type of utterance, which is a vocative utterance, is used to shift attention to a new entity in a dialogue), the recovery is not correct. As an example, let us look at the dialogue shown in (6.29).

- (6.29) a. Wonkook-i Minchul-eykey chengsacin-ul ponay-ss-ni?
 nom dat blueprint-acc send-past-int
 ‘Did Wonkook send a blueprint to Minchul?’
 (Speaker: L, Addressee: P)
- b. Sooho-ka chengsacin-ul pat-ass-eyo.
 nom blueprint-acc receive-past-dec (hon)
 ‘Sooho received the blueprint.’
 (Speaker: P, Addressee: L)
- c. Minchul-a, e selyu-lul caksengha-yess-ni?
 voc document-acc make out-past-int

⁶All orderings in (a) are possible candidates for the Cr of utterance (6.27).

(a) {K,W,H,R,choan}, {K,H,R,choan,W}, {W,K,H,R,choan}, {W,H,R,choan,K},
 {H,R,choan,K,W}, {H,R,choan,W,K}

‘Minchul, did *you* make out a document?’

(Speaker: L, Addressee: Minchul)

In utterance (6.29c) the referent of a missing constituent is the same as that of a vocative NP. Since only one constituent is missing in utterance (6.29c), its referent is the C_b of that utterance. The C_b of utterance (6.29c) is the most highly ranked element of the set C_r of its previous utterance, namely, utterance (6.29b). In utterance (6.29b) four entities are involved: *Sooho*, *chongsacin*, *P*, and *L*. According to centering theory, one of them must be the C_b of utterance (6.29c) and thus must be the referent of the missing constituent. As shown in (6.29c), however, none of them is the referent of the missing constituent. Even when we define the previous utterance of a current utterance in dialogue as the most adjacently preceding utterance whose speaker is the same as that of the current utterance, centering theory still cannot correctly recover a missing constituent in a vocative utterance. Under this definition, the previous utterance of utterance (6.29c) is utterance (6.29a), not utterance (6.29b). In utterance (6.29a) five entities are involved: *Wonkook*, *Minchul*, *chongsacin*, *L*, and *P*. The most salient entity among them is the referent of the missing constituent in utterance (6.29c). As discussed above in this section, centering theory does not provide a way to rank salience order among the following entities: the speaker, the addressee, and entities mentioned in an utterance. What is certain is that the entity *Minchul* is less salient than the entity *Wonkook* in utterance (6.29a) since an object is lower than a subject in salience order.⁷ This means that within centering theory there is no possibility for the entity *Minchul* appearing in utterance (6.29a) to be selected as the referent of the missing constituent in utterance (6.29c), though it is actually the referent of the omitted constituent, as shown in (6.29c). Therefore, regardless of the definition of a previous utterance in dialogue, centering theory cannot correctly recover a missing constituent in a vocative utterance.

6.4 Pragmatic Approach

In this section we propose a pragmatic approach to the recovery of missing constituents in dialogue. By pragmatic we mean that we use contextual information such as information about the utterance type, the preceding utterance(s) (if available),

⁷Even if the entity *Minchul* appears as the subject NP in utterance (6.29a), we still do not know whether it is the most salient entity in the utterance for the reason explained in the preceding sentence.

dialogue participants (that is, the speaker and the addressee of each utterance), and the order of the social status of the individuals involved in dialogue, as well as information about the structure of an utterance itself.

6.4.1 Recovering Algorithm

Based on the types of the omission of constituents and the referents of those omitted constituents, which are already discussed in section 6.1, we propose the algorithm shown in (6.30) to recover missing constituents in dialogue.

(6.30) Algorithm for the Recovery of Missing Constituents:

1. If a constituent is missing in an interrogative utterance where a vocative NP appears, then designate *the vocative NP* as the referent of the missing constituent. Otherwise, go to step 2.
2. If a constituent is missing in an utterance whose main predicate is the same as that of the immediately preceding utterance, then designate *the constituent's corresponding argument of the main predicate of the preceding utterance* as the referent of the missing constituent. Otherwise, go to step 3.
3. If a constituent is missing in an utterance that does not occur initially in a dialogue, then designate as the constituent's referent one of the following entities in the preferential order: *the subject NP, the indirect object NP, or the direct object NP appearing in the immediately preceding utterance*. Try a less preferred entity only if choosing a more preferred entity causes incompatibility in information about social status. Otherwise, go to step 4.
4. If two constituents are missing in an utterance, then designate as the referent of the *missing subject NP* one of the following entities in the preferential order: *the subject NP, the indirect object NP, or the direct object NP appearing in the second preceding utterance*. Likewise, designate as the referent of the *missing object NP* one of the following entities in the preferential order: *the subject NP, the indirect object NP, or the direct object NP appearing in the first preceding (i.e., the immediately*

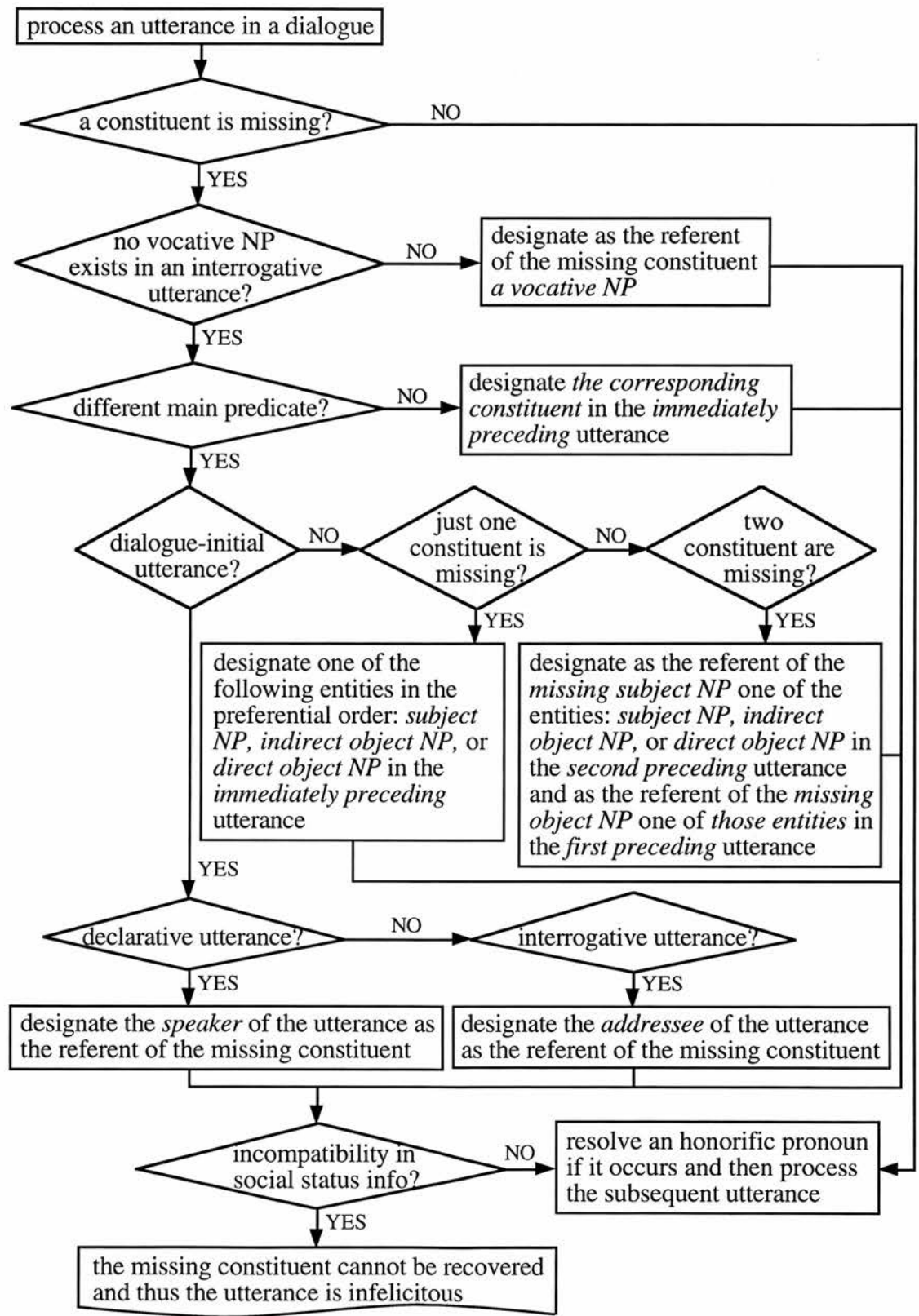
preceding) utterance. Otherwise, go to step 5.

5. If a constituent is missing in a declarative utterance that occurs initially in a dialogue, then designate *the speaker of the utterance* as the referent of the missing constituent. Otherwise, go to step 6.
6. If a constituent is missing in an interrogative utterance that occurs initially in a dialogue, then designate *the addressee of the utterance* as the referent of the missing constituent.

The algorithm proposed in (6.30) is drawn on the basis of the dialogues discussed in Section 6.1 and thus the rules in the algorithm are not hard-and-fast. For example, when the participants in a dialogue have enough mutual background knowledge about a certain horse race, the missing constituent in the initial utterance of the dialogue can be an entity related to the horse race. In this case real world knowledge, which is not mentioned at all in the dialogue, overrides the rules occurring in (6.30). Since the use of real world knowledge is beyond the scope of the dialogue processing system discussed in this thesis, it is not incorporated in the algorithm.

After finding the referents of missing constituents in an utterance based on the algorithm shown in (6.30), we check whether the result brings about incompatibility in social status information obtained from the utterance. If incompatibility occurs, we judge that missing constituents in the utterance cannot be recovered and that the utterance is infelicitous. The algorithm stated in (6.30) together with the constraint imposed by social status information can be represented as a decision chart, which is illustrated in (6.31).

(6.31) Decision Chart for Recovering Algorithm:



As shown in the chart, the recovery of missing constituents in a dialogue is constrained by the social status information obtained from the dialogue. For example, if the utterance in (6.32) occurs initially in a dialogue, the missing constituent in the utterance cannot be recovered.

(6.32) ⑥ R-kkey chochengcang-ul pwuchi-si-ess-e.
 dat (hon) invitation letter-acc mail-hon-past-dec
 ‘I mailed an invitation letter to R.’
 (Speaker: J, Addressee: H)

Since utterance (6.32) is a dialogue-initial and declarative utterance, the referent of the missing subject NP in the utterance is the speaker of the utterance. As a result of this recovery, the social status information shown in (6.33) is obtained.

(6.33) R>J, J>J, J≥H

The relation J>J (this means that the speaker of utterance (6.32) honours himself), however, is not possible in any situation and there is no other way to recover the omitted constituent. Consequently, we cannot find the appropriate referent of the missing constituent in utterance (6.32) and thus the utterance is infelicitous.

6.4.2 Application to Real Spoken Dialogue

When we apply the algorithm in (6.30) to real spoken dialogues, which were discussed in section 6.2, we get the result shown in (6.34).

(6.34)

	Dialogue L	Dialogue T	Dialogue S
Missing Constituents	31	37	41
Correct Recovery	29	34	33
Incorrect Recovery	2	3	8
Success Rate	93.5% (= $\frac{29}{31}$)	91.9% (= $\frac{34}{37}$)	80.5% (= $\frac{33}{41}$)

Successful Recovery Rate Based on Our Pragmatic Approach

Not all sentences occurring in real spoken dialogues are grammatical and many redundant words are used. Owing to these problems the result illustrated in (6.34) was obtained by hand, not by the operation of the dialogue processing system whose implementation is discussed in Chapter 7.

Both dialogue L and dialogue T belong to a spontaneous dialogue, whereas dialogue S belongs to a non-spontaneous dialogue. Thus the algorithm works very effectively in a spontaneous dialogue. The reason for this is that in a spontaneous dialogue turn-taking occurs more smoothly and more interactively than in a non-spontaneous dialogue. For example, in the non-spontaneous dialogue S, a constituent is frequently omitted even though its referent does not appear at all in the dialogue. In this case a missing constituent can be recovered only by the use of real world knowledge. In addition, the instance often occurs where a speaker suddenly inserts his own opinion with a subject constituent omitted, while talking about a person. In this situation the morpheme that appears in a verb and carries a volitional aspect can provide a clue to the recovery of the missing constituent. Furthermore, the instance occurs where a missing constituent refers to an abstract entity that is not a directly mentioned single entity, but is related to an event or a fact described earlier.⁸ The recovery of missing constituents referring to abstract entities depends on reasoning based on common sense. The incorporation of real world knowledge, information about specific aspects, and a mechanism of reasoning, however, is beyond the scope of the algorithm stated in (6.30). Thus the cases of recoveries that rely on those pieces of information cannot be correctly covered by the algorithm.

On the other hand, when we use centering theory in the recovery of omitted constituents in real spoken dialogues, we get the result illustrated in (6.35).⁹

⁸In English an abstract entity can be indicated by the pronoun *it*, as shown in dialogue (a).

- (a) i. Eric overslept.
(Speaker: Nick, Addressee: Cathy)
- ii. Did it make him late for the morning class?
(Speaker: Cathy, Addressee: Nick)

In the above dialogue the pronoun *it* refers to the event of Eric's oversleeping.

⁹The rate has been calculated on the assumption that centering theory ranks salience order appropriately for the entities related to each utterance of a dialogue (that is, those entities such as the speaker, the addressee, and the entities appearing in an utterance).

(6.35)

	Dialogue L	Dialogue T	Dialogue S
Missing Constituents	31	37	41
Correct Recovery	27	31	29
Incorrect Recovery	4	6	12
Success Rate	87.1% (= $\frac{27}{31}$)	83.8% (= $\frac{31}{37}$)	70.7% (= $\frac{29}{41}$)

Successful Recovery Rate Based on Centering Theory

A close look at the data shown in (6.34) and (6.35) shows that the rate of successful recovery by centering theory is lower than that by our pragmatic approach. The reason is that centering theory cannot recover missing constituents in dialogue-initial utterances and vocative utterances, as well as in those instances discussed above in this section. In the case of a dialogue-initial utterance no previous utterance is available. In the case of a vocative utterance the referent of a missing constituent does not appear in a previous utterance. In these two cases the referent of a missing constituent cannot be the C_b of a current utterance since the referent does not appear in the set C_r of its previous utterance or even the C_r itself cannot be obtained. This means that a missing constituent in those cases cannot be correctly recovered by centering theory.

Therefore, so far as naturally occurring dialogues are concerned, our pragmatic approach can recover missing constituents in the dialogue with higher success rate than centering theory, as supported by the data illustrated in (6.34) and (6.35).

6.5 Summary and Discussion

In everyday dialogues, constituents are frequently omitted. There is no verbal inflection which gives a clue to the referent of an omitted constituent. Moreover, a constituent can be omitted even in an utterance which occurs initially in a dialogue. The referent of a missing constituent in an utterance can be the speaker, the addressee, or an entity which is mentioned in its preceding utterance(s) (if available). Although centering theory is effective in the resolution of anaphora in discourse, the theory cannot be directly applied to the recovery of a missing constituent in dialogue. The reason is that it does not take into account information such as the speaker and the addressee of each utterance occurring in a dialogue, the utterance type (namely,

whether an utterance is of a declarative type or of an interrogative type), and information about individuals involved in a dialogue. Our pragmatic approach, which makes use of those pieces of information, is more successful in recovering missing constituents in dialogue than centering theory.

In recovering missing constituents in an utterance that does not occur initially in a dialogue, the pragmatic approach uses preference order which depends on the structure of an utterance. Though the notion of preference order is similar to that of salience order which is used in centering theory, there is a difference in the use of them. In the pragmatic approach the preference order of the entities appearing in the second preceding utterance as well as the first preceding utterance is taken into account in recovering multiple missing constituents. In centering theory, however, the salience order of the entities appearing only in the first preceding utterance is consulted in resolving multiple pronouns. Consequently, the coverage of preference order in the pragmatic approach is different from that of salience order in centering theory.

The referent of a missing constituent in a dialogue-initial utterance is the speaker or the addressee of the utterance, according to the type of the utterance. In an utterance which does not occur initially in a dialogue, the referent of a missing constituent can be an entity which appears as a subject or an object in its preceding utterance(s) as well as the speaker or the addressee of the utterance. In the recovery of missing constituents in a dialogue, incompatibility must not arise in social status information about individuals involved in the dialogue. If incompatibility still arises after all available alternatives are tried, a missing constituent cannot be recovered and thus the utterance in which the missing constituent occurs is infelicitous. Therefore, to recover missing constituents appropriately we must use structural information (that is, information about the subject or the object of an utterance and the utterance type) and contextual information (i.e., dialogue participants, information about the preceding utterance(s), and social status information).

In the next chapter we discuss the implementation of dialogue processing, in which the dialogue manager plays a central role, by covering phenomena occurring in dialogue and keeping track of information flow.

Chapter 7

Implementation

This chapter presents the implementation of our dialogue processing model. The implementation is in Prolog and uses ALE to parse utterances occurring in dialogue. Although a dialogue consists of utterances, consistency must exist between utterances in order for a dialogue to form a coherent unit. If inconsistency occurs between utterances, the dialogue containing those utterances is incoherent. The representation structure of a dialogue can be constructed only for a dialogue which is coherent. When a dialogue is incoherent, the source of the incoherence is presented.

Although we use the framework of HPSG to represent contextual information as well as syntactic and semantic information obtained from an utterance, we do not evaluate these kinds of information within that framework. Even when incompatible information may be obtained from an utterance of a dialogue, the utterance is parsed by the parsing component of a dialogue manager. The task of checking whether incompatibility occurs in information obtained from an utterance is carried out in another component of the dialogue manager, after the utterance is completely parsed. For example, irrespective of whether incompatible information about the order of social status between people is obtained from an utterance, the utterance is parsed. The evaluation of such information is carried out in the component which recovers missing constituents. Thus the framework of HPSG is used for parsing the individual utterances, not for modeling dialogue.

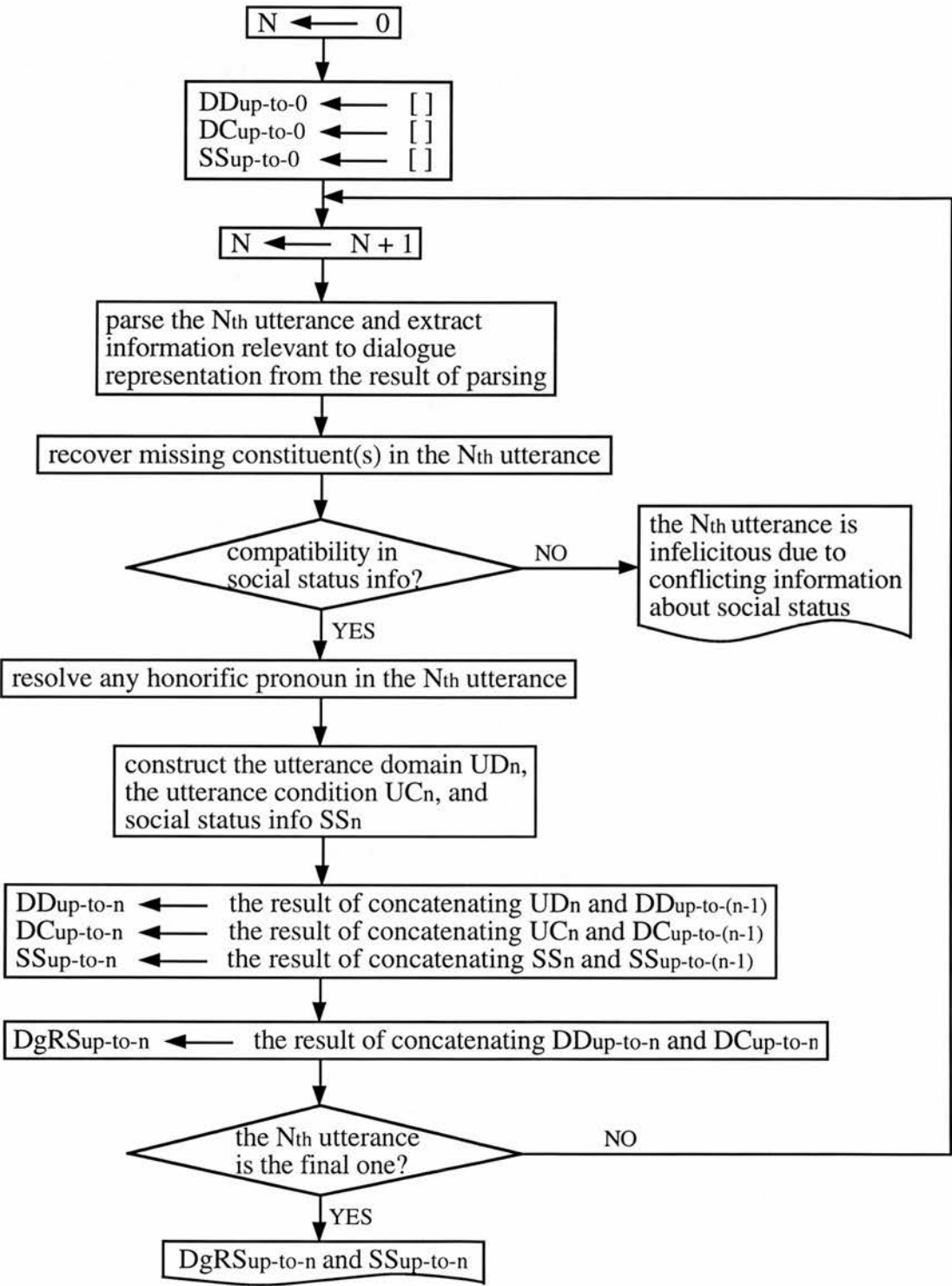
In section 7.1 the dialogue manager which controls the processing of a dialogue is discussed. In the subsequent sections the components of the dialogue manager are presented. Section 7.2 shows how an utterance is parsed. Section 7.3 presents the extraction of information relevant to the construction of a dialogue representation structure from parsed utterances. In section 7.4 we discuss the method for recovering constituents that are missing in a dialogue and checking compatibility in social status information. Section 7.5 shows how to resolve an honorific pronoun occurring in a dialogue on the basis of social status information. In section 7.6 the method for constructing dialogue representation structure is presented. Section 7.7 shows how

the order of social status is computed. The final section gives a summary of the implementation of dialogue processing.

7.1 Dialogue Manager

The task of processing a dialogue is carried out by a dialogue manager. When a dialogue is found to be coherent (that is, honorification occurs appropriately, honorific pronouns can be resolved, and missing constituents can be recovered), its representation structure together with the social status information about individuals involved in the dialogue is produced by the dialogue manager. To the contrary, when a dialogue is found to be incoherent (namely, honorification occurs inappropriately, an honorific pronoun cannot be resolved, or a missing constituent cannot be recovered), the reason for the incoherence is suggested by the dialogue manager. The mechanism of the dialogue manager is as illustrated in the flow chart appearing in (7.1).

(7.1) Chart Showing the Mechanism of the Dialogue Manager:



The algorithm represented in flow chart (7.1) can be embodied by the Prolog code shown in (7.2).¹

(7.2)

```
diag_mgr(UttsList) :-
    dialogue_manager(UttsList,1,[],[],DgRS,PreSocStat),
    compute_socstat(PreSocStat,SocStat),nl,
    pretty_print(DgRS,SocStat),
    nl, user_response.

dialogue_manager([],_,_,_,[],[],[]) :- !.
dialogue_manager([UttLs|RestUtts],UttNum,AccumUttCond,AccumStatInfo,
    [[UttDomName|DgDomName],[UttCond|DgCond]],
    [CrtStatInfo|DgStatInfo]) :-
    ale_parse_to_termstruct(UttLs,UttInfoList),
    recover(UttInfoList,UttNum,AccumUttCond,AccumStatInfo,
        RecovInfoList),
    resolve(RecovInfoList,UttNum,AccumUttCond,AccumStatInfo,
        CrtStatInfo,SofarStatInfo,ResolvInfoList),
    gen_word(UttNum,UttDomName),
    utt_cond_gen(ResolvInfoList,AccumUttCond,UttDomName,UttCond),
    NextUttNum is UttNum + 1,
    dialogue_manager(RestUtts,NextUttNum,[UttCond|AccumUttCond],
        SofarStatInfo,[DgDomName,DgCond],DgStatInfo).
```

diag_mgr/1 is the main predicate for dialogue processing. After an utterance occurring in a dialogue is parsed, missing constituents are recovered and honorific pronouns are resolved based on the information extracted from the utterance and the result of parsing its previous utterance(s) (if available). Using the information which is obtained from this recovery and resolution, the representation structure of the utterance is generated. These procedures are repeated for each utterance of a dialogue until the final utterance of the dialogue is parsed. When all utterances of a dialogue are parsed, the representation structure of the dialogue is produced.² As an example of processing a coherent dialogue, let us consider the dialogue shown in (7.3).

(7.3) a. ☺ tokile-lul paywu-ni?
 German-acc learn-int

¹For the Prolog programming language, refer to Bratko 1990, Clocksin and Mellish 1987, O'Keefe 1990, and Sterling and Shapiro 1994. For the application of Prolog to natural language processing, refer to Covington 1994, Gal, Lapalme, Saint-Dizier, and Somers 1991, Gazdar and Mellish 1989, and Pereira and Shieber 1987.

²If more than one representation structure can be constructed for a certain dialogue, all those possible representation structures are produced one by one by the help of the predicate user_response/0 appearing in the body of the predicate diag_mgr/1. The predicate user_response/0 causes a failure-driven loop.

‘Do you learn German?’

(Speaker: GM, Addressee: Sohee)

b. *e* cwungkwuke-lul paywe-yo.

Chinese-acc learn-dec (hon)

‘I learn Chinese.’

(Speaker: Sohee, Addressee: GM)

c. cwungkwuke mwuncang-i kantanha-ni?

Chinese sentence-nom simple-int

‘Is Chinese sentence simple?’

(Speaker: GM, Addressee: Sohee)

d. *e* pokcapha-yeyo.

complex-dec (hon)

‘It is complex.’

(Speaker: Sohee, Addressee: GM)

The dialogue in (7.3) is held between two persons (that is, *GM* and *Sohee*) and consists of four utterances. The form of the query for processing the dialogue is as shown in (7.4).

```
(7.4) | ?- diag_mgr([[gm,sohee,e,tokile_lul,paywu_ni],
                    [sohee,gm,e,cwungkwuke_lul,paywe_yo],
                    [gm,sohee,cwungkwuke_mwuncang_i,kantanha_ni],
                    [sohee,gm,e,pokcapha_yeyo]])).
```

The input form for each utterance of a dialogue is a Prolog list. The speaker and the addressee of an utterance are specified in that order as the first two elements of a list which corresponds to the utterance. A marker *e* is used to represent a missing constituent in an utterance. Since a missing constituent does not provide any information about an honouring relation and the order of social status, the value of the attribute related to that information is an empty set in the lexical entry for the marker. Although a way to deal with empty categories that have no orthography is provided in the form of ‘empty <desc>’ in ALE, we cannot use it to parse an utterance in which more than one constituent is contiguously missing. For example, when both

complements of a dative verb are missing in a Korean utterance, two constituents are contiguously missing. In this case ALE cannot construct the VP category appropriately.³ To get around this problem we use the marker *e* explicitly in the input form for utterances. The input form for a whole dialogue is a list of lists. The result of the query in (7.4) is illustrated in (7.5).

(7.5)

--- Dialogue Representation Structure:

```
[ [msg1,msg2,msg3,msg4],
  [inquire(gm,sh,msg1(
    [A,B,C],
    [named(A,gm),named(B,sh),named(C,german),
     main_pred(learn,B,C),
     equal_higher(A,B)])),
   say(sh,gm,msg2(
    [D],
    [named(D,chinese),
     main_pred(learn,B,D),
     not_equal(B,A)])),
   inquire(gm,sh,msg3(
    [E],
    [chns_sent(E),main_pred(simple,E),
     equal_higher(A,B)])),
   say(sh,gm,msg4(
    [],
    [main_pred(complex,E),
     not_equal(B,A)])))] ]
```

--- Relative Order of Social Status:

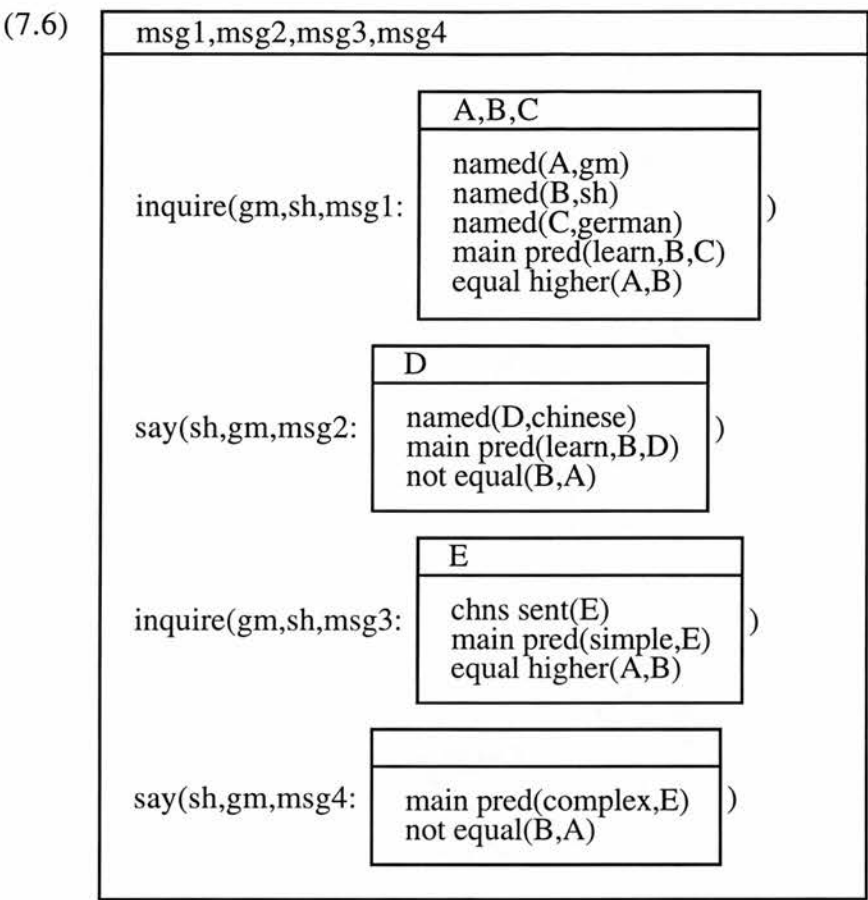
```
[higher(A,B)]
```

Further Solution? y.

```
no
| ?-
```

As shown in (7.5) the social status information obtained from an utterance is included in its representation structure. The relative order of the social status of individuals involved in a dialogue is computed based on the social status information obtained from each utterance of the dialogue. The reason why social status information is needed is that it plays an essential role in the explanation of honorification, the resolution of an honorific pronoun, and the recovery of missing constituents. The dialogue representation structure appearing in (7.5) corresponds to the graphic structure illustrated in (7.6).

³This kind of problem is mentioned in the section titled 'Empty Categories' appearing in Chapter 5 of the ALE User's Guide, which is distributed together with ALE.



The positive integer appearing in the label *msg* increases by 1 as each utterance of a dialogue is processed. For example, the DRS that represents the content of the message conveyed by the second utterance of a dialogue is labeled by *msg2*. Based on this mechanism, the dialogue manager, whose code appears in (7.2), can use information coming from previous utterances in dealing with a current utterance.

On the other hand, when a dialogue is incoherent, the representation structure of the dialogue cannot be obtained. In this case the reason for incoherence is suggested by the dialogue manager. As an example, let us look at the dialogue shown in (7.7).

- (7.7) a. R-kkeyse M-kkey choan-ul poyecwu-si-ess-e.
 nom(hon) dat(hon) draft-acc show-hon-past-dec
 ‘R showed a draft to M.’
 (Speaker: Youngsoo, Addressee: Sungmin)

b. Heesoo-ka M-ul manna-ss-ni?
 nom acc meet-past-int
 ‘Did Heesoo meet M?’
 (Speaker: Sungmin, Addressee: Youngsoo)

In dialogue (7.7) five persons (that is, *Youngsoo*, *Sungmin*, *R*, *M*, and *Heesoo*) are involved and the dialogue is held between two persons. Although there seems to be no incoherence in the dialogue at first sight, the dialogue manager detects incompatible information about social status when it processes the dialogue, as illustrated in (7.8).

(7.8)
 | ?- diag_mgr([[youngsoo,sungmin,r_kkeyse,m_kkey,choan_ul,
 poyecwu_si_ess_e],
 [sungmin,youngsoo,heesoo_ka,m_ul,manna_ss_ni]]).

The 2nd utterance in the dialogue is infelicitous since information about social status provided by the utterance is incompatible with that provided by previous utterance(s).

no
 | ?-

The reason why the dialogue is incoherent is that honorification does not occur properly in its second utterance. When the first utterance and the second utterance of the dialogue are processed, the pieces of social status information shown in (7.9a) and (7.9b) are obtained, respectively.

(7.9) a. $R \geq M$, $M > \text{Youngsoo}$, $\text{Youngsoo} \geq \text{Sungmin}$
 b. $\text{Sungmin} \geq \text{Heesoo}$, $\text{Heesoo} \geq M$, $\text{Sungmin} \geq \text{Youngsoo}$

From the relations $M > \text{Youngsoo}$ and $\text{Youngsoo} \geq \text{Sungmin}$ in (7.9a), the relation $M > \text{Sungmin}$ is inferred. The relation $\text{Sungmin} \geq M$, however, is inferred from the relations $\text{Sungmin} \geq \text{Heesoo}$ and $\text{Heesoo} \geq M$ in (7.9b). The relation $\text{Sungmin} \geq M$, which is obtained from the second utterance, is incompatible with the relation $M > \text{Sungmin}$, which is obtained from the first utterance. Thus the dialogue in (7.7) provides incompatible information about the relative order of the social status between two persons (namely, *M* and *Sungmin*). As a result of this, the dialogue is

incoherent.⁴

As illustrated in the Prolog code for the dialogue manager in (7.2), the components of the dialogue manager are the utterance parser, the information extractor (these two components are covered by the predicate `ale_parse_to_termstruct/2`), the component of recovering missing constituents (`recover/5`), the resolver of honorific pronouns (`resolve/7`), the generator of a dialogue representation structure (`utt_cond_gen/4`), and the calculator of the order of social status (`compute_socstat/2`). These components are explained one by one in the subsequent sections.

7.2 Parsing

The parsing of utterances occurring in a dialogue is carried out using the Attribute Logic Engine (ALE) system (Carpenter and Penn 1995). The reason we adopt ALE in utterance parsing is that it enables us to take advantage of HPSG, which makes it possible to incorporate contextual information related to an utterance (namely, the speaker and the addressee of an utterance, the honoring relation between individuals involved in an utterance, and the social status information about those individuals), as well as morphological, syntactic, and semantic information.⁵ By using ALE, we can encode all those information in the form of feature structures.

7.2.1 Overview of ALE

In ALE the main representational device is a typed feature structure, which consists of a type and a collection of attribute-value pairs.⁶ Since HPSG is based on a system of signs, which are represented by feature structures, it is easy to implement HPSG using

⁴In order for the dialogue to be coherent, the second utterance must be changed to the utterance illustrated below.

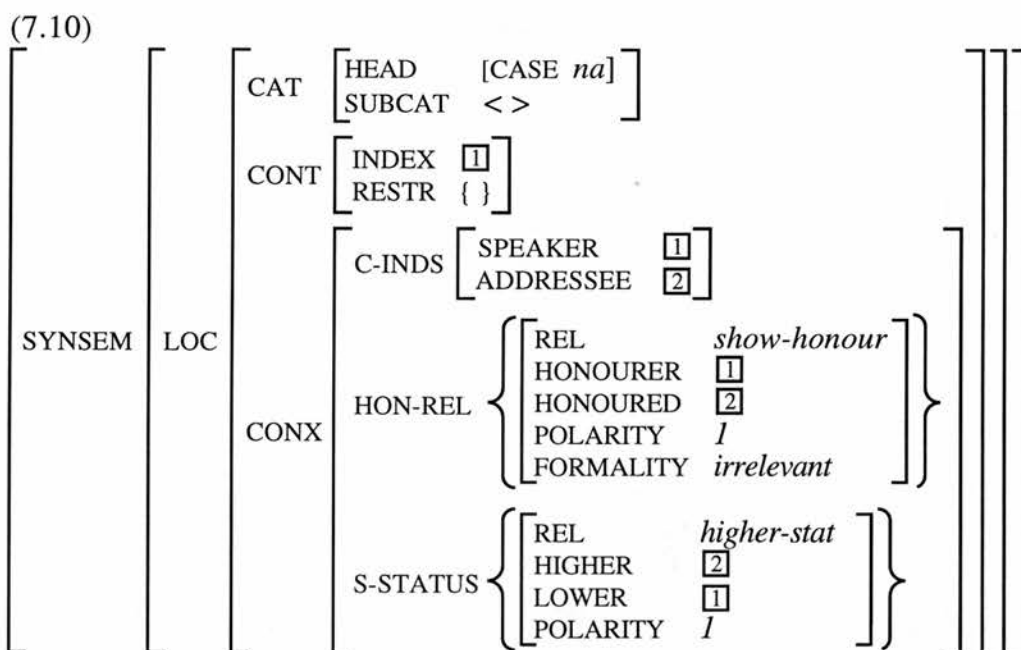
(b') Heesoo-ka M-nim-ul poy-ess-ni?
 nom hon-acc meet (hum)-past-int
 'Did Heesoo meet M?'
 (Speaker: Sungmin, Addressee: Youngsoo)

From the utterance in (b') we can obtain the social status information: $\text{Sungmin} \geq \text{Heesoo}$, $\text{M} > \text{Sungmin}$, and $\text{Sungmin} \geq \text{Youngsoo}$. These pieces of information are compatible with the information in (7.9a), which is obtained from the first utterance (that is, utterance (7.7a)). Thus the dialogue consisting of utterance (7.7a) and utterance (b') is coherent.

⁵In Chapter 3 these advantages of HPSG were discussed in detail.

⁶For a formal definition of typed feature structures, refer to Carpenter 1992.

ALE. For example, the feature structure corresponding to the SYNSEM value of the first-person humble pronoun *ce* is as illustrated in (7.10).



In ALE the feature structure illustrated in (7.10) can be coded as shown in (7.11).

(7.11)

```
word,
synsem:loc:(cat:(head:(noun,
                    case:na),
                subcat:[]),
cont:(pron,
    index:SP,
    restr:e_set),
conx:(c_inds:(speaker:SP,
              addressee:AD),
    hon_rel:(elt:(nucleus:(elt:(show_honor,
                                honorer:SP,
                                honored:AD,
                                polarity:on,
                                formality:irrelevant),
                                elts:e_set),
                        quants:[]),
                elts:e_set),
    s_status:(elt:(nucleus:(elt:(higher_stat,
                                higher:AD,
                                lower:SP),
                                elts:e_set),
                        quants:[]),
                elts:e_set))).
```

Since a pronoun is a lexical item, the type of its feature structure is *word*. An attribute is separated from its value by a colon (that is, ':'). Parentheses (i.e., '(' and ')') are used to enclose feature structures. Lists are denoted by square brackets (namely, '[' and ']'). The elements of a set are introduced by the attributes *elt* and *elts*. Structure-sharing that occurs in feature structures is indicated by the use of same variables.

The information provided by morphemes that attach to a lexical item is captured by lexical rules. The feature structure of a phrase is constructed by grammar rules on the basis of feature structures of the lexical items appearing in the phrase. For example, the grammar rule for a Korean VP that consists of an object NP and a transitive verb is as illustrated in (7.12).

(7.12)

```
% COMPLEMENT_HEAD_TR_SCHEMA (vp --> np,v)
% This schema licenses a phrase that has one complement daughter and
% a lexical head daughter
complement_head_tr rule
(Mother,phrase,synsem:loc:cat:subcat:[SubjSynsem],
      dtrs:(head_dtr:HeadDtr,comp_dtrs:[CompDtr]))
==>
cat> (CompDtr,(phrase;null_np)),
goal> (sign_to_synsem(CompDtr,CompDtrSynsem)),
cat> (HeadDtr,word,synsem:loc:cat:subcat:[SubjSynsem,
      CompDtrSynsem]),
goal> (hon_rel_consistency_principle(Mother,[CompDtr,HeadDtr]),
      s_status_consistency_principle(Mother,[CompDtr,HeadDtr]),
      c_inds_inheritance_principle(Mother,[CompDtr,HeadDtr]),
      head_feature_principle(Mother,HeadDtr),
      semantics_principle(Mother,HeadDtr)).
```

Daughters of a phrase are introduced by the operator `cat>`. Since the head daughter of a VP occurs after its complement daughter in Korean (as Korean is a head-final language), the operator `cat>` corresponding to the head daughter is declared after the operator `cat>` corresponding to the complement daughter. A complement daughter of a VP may even be omitted in Korean and thus the type of its feature structure can be `null_np`, as shown in (7.12). Relevant information provided by daughters is percolated to their mother category by the principles specified after the operator `goal>`. For example, the principle `s_status_consistency_principle` ensures that social status information provided by complement daughters and a head daughter is percolated to their mother category.

The operator `cats>`, which is provided in ALE and whose argument must be a list, cannot be used to deal with complement daughters in a head-final language such as

Korean. The reason is that in a head-final language complement daughters precede the head daughter, which subcategorizes for these complement daughters. Thus when an utterance is parsed from left to right, the argument of the operator *cats* is not properly instantiated to a list of complement daughters. To get around this problem we use more than one complement-head schema, depending on the number of complement daughters.⁷

7.2.2 Lexical Entries

The form of lexical entries in ALE is a rewriting rule, as illustrated in (7.13).

(7.13) <word> ----> <desc>

The notation in (7.13) means that the lexical item <word> satisfies the description <desc>. As an example, let us look at the lexical entry for the verb *tuli* ‘give’, which is shown in (7.14).

(7.14)

```
% give (humble form)
tuli ---->
  word,
  synsem:loc:(cat:(head:(verb,
                        mod:none,
                        tense:base,
                        root_form:hum,
                        ending_form:undf,
                        comp_form:off),
                subcat:[(@ np(Ind1,SP,AD)),
                        (@ np(Ind2,SP,AD), @ case(dat)),
                        (@ np(Ind3,SP,AD), @ case(acc))]),
  cont:(nucleus:(elt:(give_hm,
                    giver_hm:Ind1,
                    givee_hm:Ind2,
                    thing_given_hm:Ind3),
              elts:e_set),
        quants:[]),
  conx:(c_inds:(speaker:SP,
                addressee:AD),
        hon_rel:(elt:(nucleus:(elt:(show_honor,
                                    honorer:SP,
                                    honored:Ind2,
                                    polarity:on,
                                    formality:
```

⁷Another complement-head schema, which is used when two complement daughters are subcategorized for, appears in (7.28).

```

                                irrelevant),
                                elts:e_set),
                                quants:[]),
                                elts:e_set),
s_status:(elt:(nucleus:(elt:(higher_stat,
                                higher:Ind2,
                                lower:SP),
                                elts:(elt:(
                                    equal_higher_stat,
                                    equal_higher:Ind2,
                                    equal_lower:AD),
                                    elts:(elt:(
                                        higher_stat,
                                        higher:Ind2,
                                        lower:Ind1),
                                        elts:e_set))),
                                quants:[]),
                                elts:e_set))),
(@ empty_non_loc).

```

In lexical entries, the part introduced by the symbol '@' indicates that a macro is used. Once a description is defined by a macro, a shorthand for the description can be used in other descriptions. For example, the definition of the macro *np*, which takes three arguments as shown in (7.14), is as illustrated in (7.15).

(7.15)

```

np(Ind, IndS, IndA) macro
  loc:(cat:(head:noun,
            subcat:[]),
        cont:index:Ind,
        conx:c_inds:(speaker:IndS,
                     addressee:IndA)).

```

The lexical entry in (7.14) shows that the verb *tuli* subcategorizes for three NPs and is a humble form (indicated by *give_hm*). The lexical entry provides the contextual information that the verb is used in an utterance whose speaker is SP and whose addressee is AD.⁸ With regard to an honouring relation, it provides the information that the dative NP of the verb is honoured by the speaker. Concerning the order of social status, it provides the information that the social status of the dative NP is higher than that of the speaker and the nominative NP of the verb and that the social status of the dative NP is equal to or higher than that of the addressee. Thus contextual information can be included in lexical entries.

⁸These two Prolog variables are instantiated to their relevant referents, which are specified when an utterance is parsed.

Let us now look at the lexical entry for the honorific pronoun *kupwun* ‘he/she’, which is shown in (7.16).

(7.16)

```
% he/she (honorific form)
kupwun --->
  word,
  synsem:loc:(cat:(head:(noun,
                        case:na),
                subcat:[]),
               cont:(pron,
                      index:Ind,
                      restr:e_set),
               conx:(c_inds:(speaker:SP,
                             addressee:AD),
                    hon_rel:(elt:(nucleus:(elt:(show_honor,
                                                  honorer:SP,
                                                  honored:Ind,
                                                  polarity:on,
                                                  formality:
                                                    irrelevant),
                                                  elts:e_set),
                                         quants:[]),
                                elts:e_set),
                    s_status:(elt:(nucleus:(elt:(higher_stat,
                                                  higher:Ind,
                                                  lower:SP),
                                         elts:(elt:(
                                                    equal_higher_stat,
                                                    equal_higher:Ind,
                                                    equal_lower:AD),
                                                    elts:e_set))),
                                         quants:[]),
                                elts:e_set))),
               (@ empty_non_loc).
```

The lexical entry in (7.16) provides the contextual information that the referent of the honorific pronoun is honoured by the speaker of the utterance in which the pronoun occurs and that the social status of the pronoun’s referent is higher than that of the speaker and is equal to or higher than that of the addressee. Thus the referent of the honorific pronoun is an entity that satisfies these constraints.

Let us finally look at the lexical entry for a missing constituent, which is illustrated in (7.17).

(7.17)

```
% a missing NP
e --->
  null_np,
```

```

synsem:loc:(cat:(head:(noun,
                    case:(nom;dat;acc)),
            subcat:[]),
  cont:(index:_,
        restr:e_set),
        (@ unconstrained_conx)),
        (@ empty_non_loc).

```

Since a missing constituent in an utterance can be recovered by the context related to the utterance, we cannot know its referent just by looking at it. In addition, we cannot get any information about an honouring relation and the order of social status from a missing constituent itself.⁹

7.2.3 Lexical Rules

When a certain morpheme attaches to a lexical item, the information provided by the morpheme must be added to the information provided by the existing lexical entry. This is realized by lexical rules. The format of lexical rules is as shown in (7.18).

(7.18)

```

<name of lexical rule> lex_rule
  <description of input category>
**>
  <description of output category>
if <goal>
morphs
<morphological changes>

```

For example, when the honorific infix *si* attaches to the verbal root of a normal form, the lexical rule illustrated in (7.19) is used.¹⁰

⁹The definition of the macro *unconstrained_conx*, which appears in (7.17), is as illustrated in (a).

(a)

```

unconstrained_conx macro
  conx:(c_inds:(speaker:_,
                addressee:_),
        hon_rel:e_set,
        s_status:e_set).

```

¹⁰By the verbal root of a normal form, we mean that only one form is available to the verbal root. In other words, neither a distinct humble form nor a distinct honorific form is available to such a verbal root.

(7.19)

```

% Attaching the honorific infix 'si' to the verbal root of a
% normal form
honinfix_attach_to_norm_vroot lex_rule
(word,
  synsem: (loc: (cat: (head: (verb,
    mod: none,
    tense: base,
    root_form: norm,
    ending_form: undf,
    comp_form: off),
    subcat: [(@ np(Ind1,_,_)),
      (@ np(Ind2,_,_), @ case(acc))]),
    cont: Cont,
    (@ unconstrained_conx)),
  non_loc: Nil))

**>
(word,
  synsem: (loc: (cat: (head: (verb,
    mod: none,
    tense: base,
    root_form: norm,
    ending_form: undf,
    comp_form: off),
    subcat: [(@ np(Ind1,SP,AD)),
      (@ np(Ind2,SP,AD), @ case(acc))]),
    cont: Cont,
    conx: (c_inds: (speaker: SP,
      addressee: AD),
    hon_rel: (elt: (nucleus: (elt: (show_honor,
      honorer: SP,
      honored: Ind1,
      polarity: on,
      formality:
        irrelevant),
      elts: e_set),
    quants: []),
    elts: e_set),
    s_status: (elt: (nucleus: (elt: (higher_stat,
      higher: Ind1,
      lower: SP),
    elts: (elt: (
      equal_higher_stat,
      equal_higher: Ind1,
      equal_lower: AD),
      elts: e_set))),
    quants: []),
    elts: e_set))),
  non_loc: Nil))

if true
morphs
  kamtokha becomes kamtokha_si,
  caksengha becomes caksengha_si,
  kuli becomes kuli_si,
  ilk becomes ilk_usi.

```

The lexical rule in (7.19) shows that the honorific infix *si* provides the contextual information that the speaker of an utterance honours the referent of the nominative NP of a verb which is used in the utterance and that the social status of that NP's referent is higher than that of the speaker and is equal to or higher than that of the addressee. If a word contains *N* morphemes, *N* lexical rules are needed to derive the word. Thus lexical rules make it possible to systematically show the information provided by each morpheme that occurs in a word.

7.2.4 Grammar Rules

When constituents occurring in an utterance are combined, grammar rules are used. The format of grammar rules is as shown in (7.20).

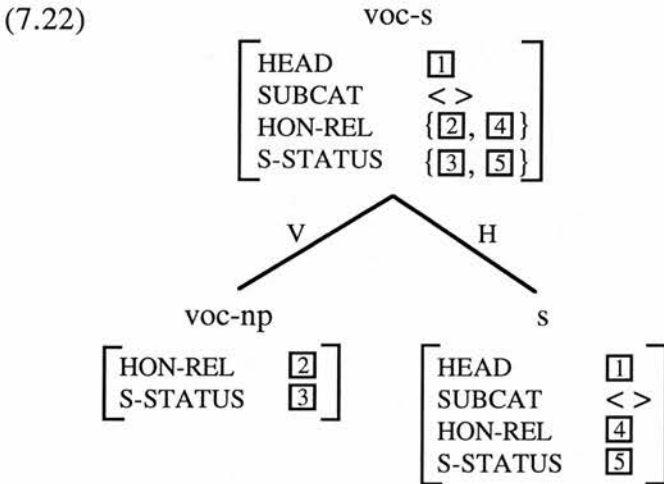
(7.20)

```
<rule_name> rule
<description of a mother category>
===>
<description of daughters and constraints on the rule>
```

As an example, let us consider the grammar rules which are needed for parsing the utterance illustrated in (7.21).

(7.21) Minchul-a, Heesoo-ka M-kkey selyu-lul tuli-ess-ni?
 voc nom dat document-acc give (hum)-past-int
 'Minchul, did Heesoo give a document to M?'
 (Speaker: P, Addressee: Minchul)

Utterance (7.21) takes the form of a vocative sentence, which consists of a vocative NP and a usual sentence. The structure of a vocative sentence is as shown in (7.22).



The HEAD value of a vocative sentence is the same as that of its head daughter (that is, the normal sentence). The HON-REL value and S-STATUS value of a vocative sentence are the collection of the HON-REL values and S-STATUS values of all its daughters (namely, its vocative daughter and head daughter), respectively. The grammar rule for parsing a vocative utterance is as shown in (7.23).

(7.23)

```
% VOCATIVE_PRAGMATIC_SENTENCE_SCHEMA
% (voc_prag_sent --> speaker,addressee,voc_np,s)
% This schema licenses a saturated vocative pragmatic sentence with
% information about its speaker and addressee, a vocative daughter,
% and a sentence
vocative_pragmatic_sentence rule
(Mother,voc_prag_sent,
  synsem:loc:conx:c_inds:(speaker:IndS,addressee:IndA),
  synsem:loc:cat:subcat:[],
  dtrs:(head_dtr:SentDtr,voc_dtr:VocDtr))

==>
cat> (_,word,synsem:loc:cont:index:IndS,
      synsem:loc:cat:head:case:na),
cat> (_,word,synsem:loc:cont:index:IndA,
      synsem:loc:cat:head:case:na),
cat> (VocDtr,phrase),
cat> (SentDtr,phrase,synsem:loc:cat:subcat:[],
      synsem:loc:cat:head:comp_form:off),
goal> (hon_rel_consistency_principle(Mother,[VocDtr,SentDtr]),
      s_status_consistency_principle(Mother,[VocDtr,SentDtr]),
      c_inds_inheritance_principle(Mother,[VocDtr,SentDtr]),
      head_feature_principle(Mother,SentDtr),
      semantics_principle(Mother,SentDtr),
      nonlocal_feature_principle(Mother,SentDtr,[VocDtr])).
```

The information about the speaker and the addressee of an utterance is used in the

C_INDS:SPEAKER value and C_INDS:ADDRESSEE value of the utterance, respectively. The principles appearing after the operator `goal>` enable relevant information to percolate from daughter categories to a mother category. For example, the S-Status Consistency Principle, which makes it possible for the social status information obtained from a daughter category to flow into its mother category, is embodied in the code shown in (7.24).

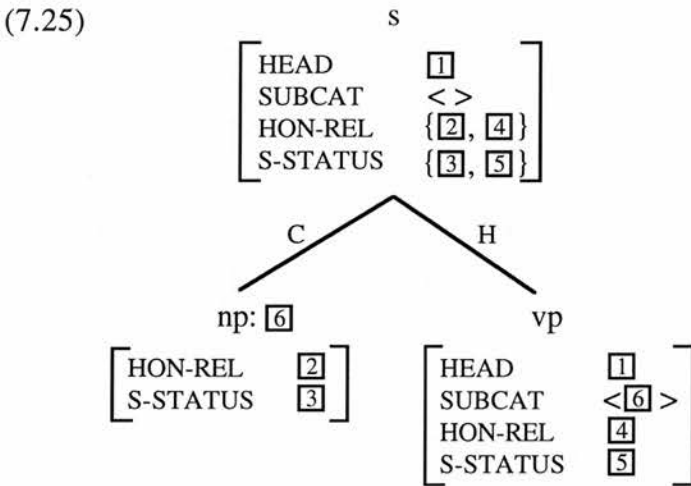
(7.24)

```
% s_status_consistency_principle(Mother, Daughters)
% -----
% The CONX:S_STATUS value of a given phrase is the union of the
% CONX:S_STATUS values of its daughters
% -----
s_status_consistency_principle((synsem:loc:conx:s_status:MStatus),
                               Dtrs) if
    status_of(Dtrs, e_set, MStatus).

status_of([], MStatus, MStatus) if
    true.
status_of([(synsem:loc:conx:s_status:e_set) | DRest], Accum, MStatus) if
    status_of(DRest, Accum, MStatus),
    !.
status_of([(synsem:loc:conx:s_status:DStatus) | DRest], Accum,
          MStatus) if
    union(Accum, DStatus, NewAccum),
    status_of(DRest, NewAccum, MStatus).
```

By collecting the social status information provided by the constituents of an utterance, we can get the information about the social status of the individuals involved in the utterance.

Let us now consider a normal sentence, which consists of a subject NP and a VP. The structure of such a sentence is as illustrated in (7.25).



The head daughter of a sentence is a VP and its complement daughter is a subject NP. The element of the SUBCAT list of the head daughter is the same as the SYNSEM value of the complement daughter. The HON-REL values and the S-STATUS values of daughter categories are passed to its mother category. The grammar rule for parsing such a sentence is as illustrated in (7.26).

(7.26)

```
% SUBJECT_HEAD_SCHEMA (s --> np, vp)
% This schema licenses a saturated phrase with
% a subject daughter and a phrasal head daughter
subject_head rule
(Mother, phrase, synsem: loc: cat: subcat: [],
  dtrs: (head_dtr: HeadDtr, subj_dtr: [SubjDtr]))
==>
cat> (SubjDtr, (phrase; null_np)),
goal> (sign_to_synsem(SubjDtr, SubjSynsem)),
cat> (HeadDtr, phrase, synsem: loc: cat: subcat: [SubjSynsem]),
goal> (hon_rel_consistency_principle(Mother, [SubjDtr, HeadDtr]),
  s_status_consistency_principle(Mother, [SubjDtr, HeadDtr]),
  c_inds_inheritance_principle(Mother, [SubjDtr, HeadDtr]),
  head_feature_principle(Mother, HeadDtr),
  semantics_principle(Mother, HeadDtr),
  nonlocal_feature_principle(Mother, HeadDtr, [SubjDtr])).
```

The grammar rule in (7.26) covers the case where a subject NP is missing in a sentence as well as the case where it is not missing.¹¹

In the vocative utterance shown in (7.21), the subject NP consists of only a proper name and thus no further structural analysis of that NP can be made. In the VP of the

¹¹A marker *e* is used to indicate that a constituent is missing. The type of the feature structure corresponding to a missing constituent is `null_np`.


```

                                CompDtr2Synsem] ),
goal> (hon_rel_consistency_principle(Mother,
                                [CompDtr1, CompDtr2, HeadDtr] ),
      s_status_consistency_principle(Mother,
                                [CompDtr1, CompDtr2, HeadDtr] ),
      c_inds_inheritance_principle(Mother,
                                [CompDtr1, CompDtr2, HeadDtr] ),
      head_feature_principle(Mother, HeadDtr ),
      semantics_principle(Mother, HeadDtr ),
      nonlocal_feature_principle(Mother, HeadDtr,
                                [CompDtr1, CompDtr2] ) ) .

```

The grammar rule in (7.28) covers the case where none of the complement daughters is missing, the case where one of them is missing, and the case where all of them are missing.

7.2.5 Output of Utterance Parsing

An utterance is parsed on the basis of lexical entries, lexical rules, and grammar rules which are related to the utterance. We use *rec/2* as the main predicate for parsing an utterance.¹² The predicate *rec/2*, which extends the predicate *rec/1* that is defined in ALE, has an argument for the result of utterance parsing. Thus by using *rec/2*, we can extract some information from the parsing result. The query form for parsing the vocative utterance in (7.21) is as shown in (7.29).

```

(7.29) | ?- rec([p,minchul,minchul_a,heesoo_ka,m_kkey,selyu_lul,
                tuli_ess_ni],AVL) .

```

The information about the speaker and the addressee of an utterance is included in the input list along with the constituents of the utterance. The output part corresponding to the subject NP *Heesoo-ka* is as shown in (7.30).¹³

```

(7.30)
synsem: (_1619,
        synsem,
        loc: (loc,
              cat: (cat,
                   head: (noun,
                        case: nom) ,

```

¹²*rec/2* was written by Chris Brew and Ioannis Androutsopoulos. Thanks go to Chris Brew for allowing me to use the file where the predicate is defined.

¹³For the sake of legibility, outputs shown in this section are formatted by the predicate *avl_pretty_print/1* that is defined together with *rec/2*.

```

        subcat:e_list),
cont:(nom_obj,
      index:(_1583,
             hs),
      restr:e_set),
conx:(conx,
      c_inds:(_1570,
              c_inds,
              addressee:(_1564,
                          mc),
              speaker:(_1561,
                        p)),
      hon_rel:(ne_set_psoa,
                elt:(_1552,
                     psOA,
                     nucleus:(ne_set_qfpsoa,
                               elt:(show_honor,
                                     formality:irrelevant,
                                     honored:_1583,
                                     honorer:_1561,
                                     polarity:off),
                               elts:e_set),
                               quants:e_list),
                               elts:e_set),
                s_status:(ne_set_psoa,
                           elt:(_1505,
                                psOA,
                                nucleus:(ne_set_qfpsoa,
                                          elt:(equal_higher_stat,
                                                equal_higher:_1561,
                                                equal_lower:_1583),
                                          elts:e_set),
                                          quants:e_list),
                              elts:e_set))),
non_loc:(non_loc,
          inherited:(non_loc_s,
                     slash:e_set),
          to_bind:(non_loc_s,
                   slash:e_set))))),

```

As shown in (7.30) the information about the speaker and the addressee of utterance (7.21) is incorporated in the value of `conx:c_inds`. The information about the honouring relation and the order of social status obtained from the subject NP is incorporated in the value of `conx:hon_rel` and `conx:s_status`, respectively.

Let us look at the output part corresponding to the verb *tuli-ess-ni* of utterance (7.21), which is shown in (7.31).

(7.31)

```

loc:(loc,
     cat:(cat,
          head:(_1096,

```

```

        verb,
        comp_form:off,
        ending_form:int,
        mod:none,
        root_form:hum,
        tense:past),
    subcat:(ne_list_synsem,
            hd:_1619,
            tl:(ne_list_synsem,
                hd:_1424,
                tl:(ne_list_synsem,
                    hd:_1235,
                    tl:e_list))))),
    cont:(_1042,
        psoa,
        nucleus:(ne_set_qfpsoa,
            elt:(give_hm,
                givee_hm:_1388,
                giver_hm:_1583,
                thing_given_hm:_1199),
            elts:e_set),
        quants:e_list),
    conx:(conx,
        c_inds:_1570,
        hon_rel:(_998,
            ne_set_psoa,
            elt:(psoa,
                nucleus:(ne_set_qfpsoa,
                    elt:(show_honor,
                        formality:irrelevant,
                        honored:_1388,
                        honorer:_1561,
                        polarity:on),
                    elts:(ne_set_qfpsoa,
                        elt:(show_honor,
                            formality:irrelevant,
                            honored:_1583,
                            honorer:_1561,
                            polarity:off),
                        elts:(ne_set_qfpsoa,
                            elt:(show_honor,
                                formality:informal,
                                honored:_1564,
                                honorer:_1561,
                                polarity:off),
                            elts:e_set))))),
                quants:e_list),
            elts:e_set),
        s_status:(_899,
            ne_set_psoa,
            elt:(psoa,
                nucleus:(ne_set_qfpsoa,
                    elt:(higher_stat,
                        higher:_1388,
                        lower:_1561),
                    elts:(ne_set_qfpsoa,
                        elt:(equal_higher_stat,

```

```

equal_higher:_1388,
equal_lower:_1564),
elts:(ne_set_qfpsoa,
elt:(higher_stat,
higher:_1388,
lower:_1583),
elts:(ne_set_qfpsoa,
elt:(equal_higher_stat,
equal_higher:_1561,
equal_lower:_1583),
elts:(ne_set_qfpsoa,
elt:(equal_higher_stat,
equal_higher:_1561,
equal_lower:_1564),
elts:e_set))))),
quants:e_list),
elts:e_set))),
non_loc:(non_loc,
inherited:(non_loc_s,
slash:e_set),
to_bind:(non_loc_s,
slash:e_set))))),

```

Since the verb of utterance (7.21) is a ditransitive verb, three elements appear in the value of `cat:subcat` and three entities are specified in the value of `loc:cont`. The speaker and the addressee do not change within an utterance and thus all constituents of an utterance have the same value of `c_inds` (for example, the value of `c_inds` in (7.30) is identical to that of `c_inds` in (7.31), as both values are indicated by the Prolog variable `_1570`). The information about the honouring relation and the order of social status obtained from the verb is displayed in the value of `hon_rel` and `s_status`, respectively, as in (7.30).

Let us now look at the output part corresponding to the vocative NP *Minchul-a* of utterance (7.21), which is illustrated in (7.32).¹⁴

(7.32)

```

synsem:(synsem,
loc:(loc,
cat:(cat,
head:(noun,
case:voc),
subcat:e_list),
cont:(nom_obj,

```

¹⁴In ALE the result of a parsed utterance is shown in alphabetical order of feature names. Since the subject NP is the subject daughter (`subj_dtr`) of an utterance, the complements of a verb are the complement daughters (`comp_dtrs`), the verb is the head daughter (`head_dtr`), and the vocative NP is the vocative daughter (`voc_dtr`) of the utterance, the output part corresponding to the vocative NP appears after the output parts corresponding to all other constituents of an utterance are displayed.

```

        index: (_548,
                mc),
        restr: e_set),
    conx: (conx,
          c_inds: _1570,
          hon_rel: (ne_set_psoa,
                    elt: (_526,
                          psOA,
                          nucleus: (ne_set_qfpsoa,
                                    elt: (show_honor,
                                          formality: irrelevant,
                                          honored: _548,
                                          honorer: _1561,
                                          polarity: off),
                                          elts: e_set),
                                    quants: e_list),
                                    elts: e_set),
          s_status: (ne_set_psoa,
                     elt: (_479,
                           psOA,
                           nucleus: (ne_set_qfpsoa,
                                     elt: (equal_higher_stat,
                                           equal_higher: _1561,
                                           equal_lower: _548),
                                           elts: e_set),
                                     quants: e_list),
                           elts: e_set))),
    non_loc: (non_loc,
              inherited: (non_loc_s,
                          slash: e_set),
              to_bind: (non_loc_s,
                        slash: e_set))))),

```

Since a vocative case marker attaches to the vocative NP of utterance (7.21), the value of `head:case` is `voc`. The value of `c_inds` for this NP is identical to that of `c_inds` for other constituents of the utterance. The information about the honouring relation and the order of social status obtained from this vocative NP is incorporated in the value of `hon_rel` and `s_status`, respectively,

Finally, the output corresponding to utterance (7.21) is as illustrated in (7.33).

(7.33)

```

synsem: (synsem,
        loc: (loc,
              cat: (cat,
                    head: _1096,
                    subcat: e_list),
              cont: _1042,
              conx: (conx,
                    c_inds: _1570,
                    hon_rel: (ne_set_psoa,
                              elt: _526,

```

```

                                elts:_635)),
    s_status:(ne_set_psoa,
              elt:_479,
              elts:_623))),
  non_loc:(non_loc,
            inherited:(non_loc_s,
                       slash:e_set))))

```

At utterance level, no atomic value appears. The reason is that the values appearing in the constituents of an utterance are percolated to the utterance by grammatical rules. For example, the `head` value of utterance (7.21) is identical to that of its head daughter shown in (7.31) (both values are indicated by the Prolog variable `_1096`). The `non_rel` value and `s_status` value at utterance level are the collection of their corresponding values appearing at constituent level. Thus those values are represented by a set.

7.3 Extracting Information Relevant to Dialogue Representation

After each utterance occurring in a dialogue is parsed, the information which is needed in constructing the representation structure of the dialogue is extracted from the result of utterance parsing. To construct a dialogue representation structure, the information such as the speaker and the addressee of each utterance, the referents of entities related to each utterance, the order of the social status of individuals involved in each utterance, the type of each utterance, and the argument structure of a predicate must be used. The main predicate for extracting such information from the parsing result, which takes the form of output shown in section 7.2.5, is as shown in (7.34).

(7.34)

```

% When extracting all pieces of information relevant to dialogue
% representation from a complex AVL form, this predicate is used
extract(AVL, InfoList) :-
    AVL =.. [_|ArgsList], % (a,b) =.. ['',[a,b]]. b:c =.. [:|[b,c]]
    collect_args(ArgsList, MidList),
    flatten(MidList, InfoList).

% collect_args(Ls1, Ls2) succeeds if Ls2 is the result of collecting
% pieces of information relevant only to dialogue representation
% from Ls1
collect_args([], []).
collect_args([H1|Ls1], [H2|RelArgs]) :-
    extract(H1, H2),

```



```

H2 \== [],
!,
collect_args(Ls1,RelArgs).
collect_args([_|Ls1],RelArgs) :-
    collect_args(Ls1,RelArgs).

```

When going through the parsing result, the information which is not relevant to dialogue representation is ignored, whereas all information which is relevant to dialogue representation is collected. Let us look at the specific cases.

In order to get the information about a missing constituent in an utterance, the code shown in (7.35) is used.

(7.35)

```

% Information about a missing NP is extracted (the index of a
% missing NP is not yet known)
extract((nom_obj,
          index:(Var,
                 ind),
          restr:_),
        null_np(Var,nullind_nyk)) :- !.

```

When an utterance is parsed, the referent of a missing constituent in the utterance is not yet known until the information about other constituents of the utterance and the information about its previous utterance is consulted. When a missing constituent is recovered, the Prolog atom `nullind_nyk` appearing in (7.35) is replaced with the referent of the missing constituent.

Similarly, the referent of a pronoun is not known until the pronoun is resolved. The code shown in (7.36) is used to get the information about a pronoun occurring in an utterance.

(7.36)

```

% Information about a pronoun is extracted (the index of a pronoun
% is not yet known)
extract((pron,
          index:(Var,
                 ind),
          restr:e_set),
        pro(Var,proind_nyk)) :- !.

```

When a pronoun is resolved, the Prolog atom `proind_nyk` appearing in (7.36) is replaced with the referent of the pronoun.

In obtaining social status information, the code illustrated in (7.37) is used.

(7.37)

```
% Information about relative social status of individuals involved
% in an utterance is extracted
extract((equal_higher_stat,
        equal_higher:Ind1,
        equal_lower:Ind2),
        equal_higher(Ind1,Ind2)) :- !.
extract((higher_stat,
        higher:Ind1,
        lower:Ind2),
        higher(Ind1,Ind2)) :- !.
extract((not_equal_stat,
        not_equal1:Ind1,
        not_equal2:Ind2),
        not_equal(Ind1,Ind2)) :- !.
```

Three Prolog predicates (that is, `equal_higher/2`, `higher/2`, and `not_equal/2`) are used to represent the relative order of the social status of individuals involved in an utterance.

The information about a predicate occurring in an utterance is extracted together with the information on social status obtainable from the predicate. In the case where a non-main predicate (for example, the predicate occurring in an embedded clause) is a ditransitive verb, the code for extracting the information about the predicate is as illustrated in (7.38).

(7.38)

```
extract(head_dtr:(word,
                  synsem:(_,
                          loc:(_,
                              cat:(_,
                                  head:(_,
                                      _,
                                      comp_form:on,
                                      _,'_','_','_'),
                                      subcat:_),
                                  cont:(Var,psoa,
                                      nucleus:(ne_set_qfpsoa,
                                          elt:(Type,
                                              _:Ind1,
                                              _:Ind2,
                                              _:Ind3),
                                          elts:e_set),
                                      quants:_),
                                  conx:Conx),
                              non_loc:_)),
                  [refer(Var,pred(Type,Ind2,Ind1,Ind3)),Status]) :-
extract(Conx,Status), !.
```

Since a complementizer is incorporated in a non-main predicate in Korean, the value of `head:comp_form` for the non-main predicate is `on`, as shown in (7.38). The structure of a non-main predicate of an utterance can be an argument of the main predicate of the utterance. The part `refer(Var, pred(Type, Ind2, Ind1, Ind3))` in (7.38) makes it possible to embody this notion. In other words, the notion is realized by making a single Prolog variable refer to the structure of a non-main predicate (for example, `pred(Type, Ind2, Ind1, Ind3)`) and making that variable appear as an argument of the main predicate.

In the case where the main predicate of an utterance is a ditransitive verb, the information about the predicate is extracted by the code illustrated in (7.39).

(7.39)

```
extract(head_dtr:(word,
                  synsem:(_,
                        loc:(_,
                            cat:(_,
                                head:(_,
                                    _,
                                    comp_form:off,
                                    ending_form:Form,
                                    _,_,_),
                                subcat:_),
                            cont:(_,psoa,
                                nucleus:(ne_set_qfpsoa,
                                    elt:(Type,
                                        _:Ind1,
                                        _:Ind2,
                                        _:Ind3),
                                    elts:e_set),
                                quants:_),
                                conx:Conx),
                            non_loc:_)),
                  [main_pred(Type, Ind2, Ind1, Ind3), type_of_utt(Form), Status]) :-
    extract(Conx, Status), !.
```

When the information about the main predicate of an utterance is extracted, the type of the utterance (i.e., declarative or interrogative) that depends on the verbal ending form of the main predicate is also extracted.

Let us now look at example outputs which are obtained by extracting the information relevant to dialogue representation from an utterance. The Prolog predicate for extracting information from an utterance is as shown in (7.40).¹⁵

¹⁵This predicate is used in the dialogue manager for processing dialogue, as illustrated in (7.2).

(7.40)

```
ale_parse_to_termstruct(UttList,UttInfoList) :-
    rec(UttList,AVL),
    extract(AVL,UttInfoList).
```

After an utterance is parsed, the information which is needed in the construction of dialogue representation structure is extracted from the parsed result. First, let us look at the information extracted from the utterance shown in (7.41), where no constituent is omitted.

(7.41) H-kkeyse P-eykey choan-ul poyecwu-si-ess-e.
 nom (hon) dat draft-acc show-hon-past-dec
 ‘H showed a draft to P.’
 (Speaker: K, Addressee: R)

The query for extracting information from utterance (7.41) is shown in (7.42).

(7.42)

```
| ?- ale_parse_to_termstruct([k,r,h_kkeyse,p_eykey,choan_ul,
                             poyecwu_si_ess_e],InfoLs).
```

The output from the query is as illustrated in (7.43).

(7.43)

```
InfoLs = [named(_O,h),addressee(_M,r),speaker(_N,k),higher(_O,_N),
equal_higher(_O,_M),named(_P,p),equal_higher(_N,_P),ind(_Q,drft),
main_pred(show_nh,_O,_P,_Q),type_of_utt(dec),equal_higher(_O,_P),
higher(_O,_N),equal_higher(_O,_M),equal_higher(_N,_M)]
```

In the Prolog list `InfoLs` all information relevant to dialogue representation is contained. For example, the element `equal_higher(_N,_M)` provides the information that the social status of the speaker (`_N` stands for the speaker by `speaker(_N,k)`) is equal to or higher than that of the addressee (`_M` stands for the addressee by `addressee(_M,r)`).

When the indirect object NP is omitted from utterance (7.41), the query for extracting information is as illustrated in (7.44).

(7.44)

```
| ?- ale_parse_to_termstruct([k,r,h_kkeyse,e,choan_ul,
```

```
poyecwu_si_ess_e], InfoLs).
```

In this case the extracted information is as shown in (7.45).

(7.45)

```
[named(_K,h),addressee(_I,r),speaker(_J,k),higher(_K,_J),
equal_higher(_K,_I),null_np(_L,nullind_nyk),ind(_M,drft),
main_pred(show_nh,_K,_L,_M),type_of_utt(dec),equal_higher(_K,_L),
higher(_K,_J),equal_higher(_K,_I),equal_higher(_J,_I)]
```

The information extracted from the missing constituent is represented by `null_np(_L,nullind_nyk)`. Since the variable `_L` that stands for the missing constituent appears in the element that provides social status information (for example, `equal_higher(_K,_L)`), the recovery of the missing constituent has an effect on social status information.

Finally, let us look at the information extracted from an utterance where more than one predicate occurs. The utterance shown in (7.46) contains an embedded clause.

(7.46) Koo sacang-nim-i Kang kwacang-i pokose-lul
 president-hon-nom chief-section-nom report-acc
 caksengha-yess-tako mit-usi-eyo.
 write out-past-comp believe-hon-dec (hon)
 'President Koo believes that chief-section Kang wrote out a report.'
 (Speaker: YK, Addressee: PS)

The query for extracting the information relevant to dialogue representation from utterance (7.46) is as illustrated in (7.47).

(7.47)

```
| ?- ale_parse_to_termstruct([yk,ps,koo_sacang_nim_i,kang_kwacang_i,
                             pokose_lul,caksengha_yess_tako,
                             mit_usi_eyo], InfoLs).
```

The information extracted by the query is shown in (7.48).

(7.48)

```
[named(_O,koo_pres),addressee(_M,ps),speaker(_N,yk),
higher(_O,_N),equal_higher(_O,_M),named(_X,kang_chsc),
equal_higher(_N,_X),ind(_Y,rpt),refer(_P,pred(write_out,_X,_Y)),
```

```
main_pred(believe,_O,_P),type_of_utt(dec),higher(_O,_N),
equal_higher(_O,_M),not_equal(_N,_M)]
```

The element `refer(_P,pred(write_out,_X,_Y))` represents the predicate occurring in the embedded clause and the element `main_pred(believe,_O,_P)` represents the predicate occurring in the main clause of utterance (7.46). By the mediation of the variable `_P` that appears in both elements, `main_pred(believe,_O,_P)` is interpreted as `main_pred(believe,_O,pred(write_out,_X,_Y))`. The information about social status is extracted from both the embedded clause and the main clause.

7.4 Recovering Missing Constituents and Checking Compatibility

The recovery of missing constituents in an utterance depends on the information about the speaker and the addressee of the utterance, the type of the utterance, its preceding utterance(s) (if available), and the relative order of social status.¹⁶ The Prolog predicate for recovering missing constituents is `recover/5`, as shown in the code for dialogue manager, which has appeared in (7.2). According to the situation where a constituent is missing, the definition of the predicate varies. On the basis of the dialogue shown in (7.49), let us look at the predicate for recovering constituents that are missing in the dialogue.

(7.49) a. e pwule-lul paywu-ni?
 French-acc learn-int
 ‘Do you learn French?’
 (Speaker: K, Addressee: R)

b. e sepanae-lul paywe-yo.
 Spanish-acc learn-dec (hon)
 ‘I learn Spanish.’
 (Speaker: R, Addressee: K)

c. sepanae mwuncang-i kantanha-ni?
 Spanish sentence-nom simple-int

¹⁶For the detailed discussion about recovering missing constituents, refer to Chapter 6.

'Is Spanish sentence simple?'

(Speaker: K, Addressee: R)

d. e pokcapha-yeyo.

complex-dec (hon)

'It is complex.'

(Speaker: R, Addressee: K)

In the initial utterance, which takes the form of an interrogative utterance, a constituent is omitted. This missing constituent is recovered by the predicate shown in (7.50).

(7.50)

```
recover(UttInfoList,UttNum,AccumUttCond,AccumStatInfo,
        RecovInfoList) :-
    UttNum = 1,
    member(type_of_utt(int),UttInfoList),
    member(null_np(_,_),UttInfoList),
    !,
    member(addressee(_,IndAD),UttInfoList),
    subst(null_np(NullVar,_),named(NullVar,IndAD),
          UttInfoList,RecovInfoList),
    bind_samevar_across(RecovInfoList,AccumUttCond),
    create_crtstatinfo(RecovInfoList,CrtStInfo),
    informative_check_crtstatinfo_compat(UttNum,CrtStInfo),
    create_sofarstatinfo(AccumStatInfo,CrtStInfo,SofarStInfo),
    informative_check_sofarstatinfo_compat(UttNum,SofarStInfo).
```

The first argument of `recover/5` is a Prolog list containing the information extracted from an utterance that is currently being dealt with. The second argument `UttNum` indicates the number that corresponds to the order in which the current utterance occurs in a dialogue (for example, if the current utterance is the third utterance of a dialogue, the argument is instantiated to 3). The third argument `AccumUttCond` is a list whose elements are the representation structures of utterances that precede the current utterance (if the current utterance is the initial utterance of a dialogue, the value of this argument is an empty list) and thus contains the information obtained from all preceding utterances. The fourth argument `AccumStatInfo` is a list containing the information about the order of the social status of individuals involved in all preceding utterances. The final argument is a list showing the result of recovering a missing constituent. In the process of recovering missing constituents, it is checked whether the referent of the recovered constituent gives rise to incompatibility in social status

information within the current utterance itself (by the predicate `informative_check_crtstatinfo_compat/2`) and in the context of utterances that are so far processed, i.e., utterances from the initial utterance up to the current utterance (by the predicate `informative_check_sofarstatinfo_compat/2`). By means of the predicate in (7.50), the referent of the missing constituent in utterance (7.49a) is found to be the same as that of the addressee of the utterance.

In utterance (7.49b), which is a non-initial utterance of dialogue (7.49), a subject NP is omitted. A vocative NP does not occur in the utterance and the main predicate of the utterance is the same as that of its immediately preceding utterance. Thus the recovery of the missing subject NP in the utterance is made by the predicate illustrated in (7.51).

(7.51)

```
recover (UttInfoList, UttNum, AccumUttCond, AccumStatInfo,
        RecovInfoList) :-
    \+ UttNum = 1,
    nth_member(1, AccumUttCond, PrevUttCond),
    arg(3, PrevUttCond, PrevUttMsg),
    arg(2, PrevUttMsg, PrevUttContList),
    main_predicate(Prd, 2, PrevUttContList),
    main_predicate(Prd, 2, UttInfoList),
    member(null_np(NullVar, _), UttInfoList),
    subjvar_of_utt(SubjVar, UttInfoList),
    NullVar == SubjVar,
    !,
    ( (subj_pn_in_uttcontlist(PrevUttContList, AccumUttCond, SubjIndPN),
      strict_subst(null_np(NullVar, _), named(NullVar, SubjIndPN),
                  UttInfoList, RecovInfoList));
      (subj_npn_in_uttcontlist(PrevUttContList, AccumUttCond,
                              SubjIndNPN),
        Q =.. [SubjIndNPN, NullVar],
        strict_subst(null_np(NullVar, _), Q,
                    UttInfoList, RecovInfoList)) ),
    bind_samevar_across(RecovInfoList, AccumUttCond),
    create_crtstatinfo(RecovInfoList, CrtStInfo),
    informative_check_crtstatinfo_compat(UttNum, CrtStInfo),
    create_sofarstatinfo(AccumStatInfo, CrtStInfo, SofarStInfo),
    informative_check_sofarstatinfo_compat(UttNum, SofarStInfo).
```

By the predicate in (7.51), the referent of the missing subject NP in utterance (7.49b) is found to be the same as that of its corresponding constituent (namely, the subject NP) in its immediately preceding utterance. This recovery does not give rise to incompatibility in social status information (that is, `not_equal(k, r)` which is obtained after the recovery of the missing constituent in utterance (7.49b) is compatible with `equal_higher(r, k)` which is obtained from utterance (7.49a)).

In the third utterance of dialogue (7.49), no constituent is missing. So it is necessary only to check whether the social status information obtained from the utterance does not contain incompatible information and is also compatible with the social status information obtained from its preceding utterances, as shown by the predicate in (7.52).

(7.52)

```
recover (UttInfoList, UttNum, AccumUttCond, AccumStatInfo,
        UttInfoList) :-
    \+ member(null_np(_, _), UttInfoList),
    bind_samevar_across (UttInfoList, AccumUttCond),
    create_crtstatinfo (UttInfoList, CrtStInfo),
    informative_check_crtstatinfo_compat (UttNum, CrtStInfo),
    create_sofarstatinfo (AccumStatInfo, CrtStInfo, SofarStInfo),
    informative_check_sofarstatinfo_compat (UttNum, SofarStInfo).
```

From utterance (7.49c) the social status information `equal_higher(r, k)` is obtained and this information is compatible with the social status information collected from its preceding utterances.

In the final utterance of dialogue (7.49), a constituent is missing. A vocative NP does not occur in the utterance and the main predicate of the utterance is different from that of its immediately preceding utterance. In this case the referent of the missing constituent is first assumed to be the same as that of *the subject NP* in the immediately preceding utterance, as illustrated by the predicate in (7.53).

(7.53)

```
recover (UttInfoList, UttNum, AccumUttCond, AccumStatInfo,
        RecovInfoList) :-
    \+ UttNum = 1,
    member (addressee(_, Indx), UttInfoList),
    \+ member (named(_, Indx), UttInfoList),
    member (null_np(_, _), UttInfoList),
    !,
    nth_member (1, AccumUttCond, PrevUttCond),
    arg (3, PrevUttCond, PrevUttMsg),
    arg (2, PrevUttMsg, PrevUttContLs),
    ( (subj_pn_in_uttcontlist (PrevUttContLs, AccumUttCond, SubjIndPN),
        subst (null_np (NullVar, _), named (NullVar, SubjIndPN),
              UttInfoList, RecovInfoList));
      (subj_npn_in_uttcontlist (PrevUttContLs, AccumUttCond, SubjIndNPN),
        Q =.. [SubjIndNPN, NullVar],
        subst (null_np (NullVar, _), Q, UttInfoList, RecovInfoList)) ),
    !,
    bind_samevar_across (RecovInfoList, AccumUttCond),
    create_crtstatinfo (RecovInfoList, CrtStInfo),
    just_check_crtstatinfo_compat (CrtStInfo),
```

```
create_sofarstatinfo(AccumStatInfo,CrtStInfo,SofarStInfo),
just_check_sofarstatinfo_compat(SofarStInfo).
```

If the recovery of a missing constituent based on the predicate in (7.53) causes incompatibility in social status information, the referent of the missing constituent is assumed to be the same as that of *the indirect object NP* of the immediately preceding utterance. This alternative recovery is made by the predicate in (7.54).

(7.54)

```
recover(UttInfoList,UttNum,AccumUttCond,AccumStatInfo,
       RecovInfoList) :-
  \+ UttNum = 1,
  member(addressee(_,Indx),UttInfoList),
  \+ member(named(_,Indx),UttInfoList),
  member(null_np(_,_),UttInfoList),
  !,
  nth_member(1,AccumUttCond,PrevUttCond),
  arg(3,PrevUttCond,PrevUttMsg),
  arg(2,PrevUttMsg,PrevUttContLs),
  ( (indrtoobj_pn_in_uttcontlist(PrevUttContLs,AccumUttCond,
                               InDrtObjIndPN),
    subst(null_np(NullVar,_),named(NullVar,InDrtObjIndPN),
          UttInfoList,RecovInfoList));
    (indrtoobj_npn_in_uttcontlist(PrevUttContLs,AccumUttCond,
                                InDrtObjIndNPN),
     Q =.. [InDrtObjIndNPN,NullVar],
     subst(null_np(NullVar,_),Q,UttInfoList,RecovInfoList)) ),
  !,
  bind_samevar_across(RecovInfoList,AccumUttCond),
  create_crtstatinfo(RecovInfoList,CrtStInfo),
  just_check_crtstatinfo_compat(CrtStInfo),
  create_sofarstatinfo(AccumStatInfo,CrtStInfo,SofarStInfo),
  just_check_sofarstatinfo_compat(SofarStInfo).
```

If this recovery still causes incompatibility in social status information, the last alternative method, which assumes that the referent of the missing constituent is the same as that of *the direct object NP* of the immediately preceding utterance, is used. This last alternative recovery is made by the predicate in (7.55).

(7.55)

```
recover(UttInfoList,UttNum,AccumUttCond,AccumStatInfo,
       RecovInfoList) :-
  \+ UttNum = 1,
  member(addressee(_,Indx),UttInfoList),
  \+ member(named(_,Indx),UttInfoList),
  member(null_np(_,_),UttInfoList),
  !,
  nth_member(1,AccumUttCond,PrevUttCond),
```

```

arg(3,PrevUttCond,PrevUttMsg),
arg(2,PrevUttMsg,PrevUttContLs),
( (drtobj_pn_in_uttcontlist(PrevUttContLs,AccumUttCond,
                             DrtObjIndPN),
  subst(null_np(NullVar,_),named(NullVar,DrtObjIndPN),
        UttInfoList,RecovInfoList));
  (drtobj_npn_in_uttcontlist(PrevUttContLs,AccumUttCond,
                             DrtObjIndNPN),
  Q =.. [DrtObjIndNPN,NullVar],
  subst(null_np(NullVar,_),Q,UttInfoList,RecovInfoList)) ),
!,
bind_samevar_across(RecovInfoList,AccumUttCond),
create_crtstatinfo(RecovInfoList,CrtStInfo),
informative_check_crtstatinfo_compat(UttNum,CrtStInfo),
create_sofarstatinfo(AccumStatInfo,CrtStInfo,SofarStInfo),
informative_check_sofarstatinfo_compat(UttNum,SofarStInfo).

```

If the last alternative recovery still brings about incompatibility in social status information, it is judged that the missing constituent cannot be recovered. In the case of utterance (7.49d), the recovery made by the predicate in (7.53) does not give rise to incompatibility in social status information (that is, `not_equal(k,r)` which is obtained after the recovery of the missing constituent in utterance (7.49d) is compatible with the social status information collected from all its preceding utterances) and thus other alternative methods are not used. In fact, since utterance (7.49c), which is the immediately preceding utterance of the utterance in (7.49d) where a constituent is missing, contains neither an indirect object NP nor a direct object NP, the alternative methods cannot be applied to the recovery of the missing constituent. The opportunity of using alternative methods can be provided when the immediately preceding utterance contains an indirect object NP (for example, by the occurrence of a dative verb) or a direct object NP (for instance, by the occurrence of a transitive verb).

Let us now consider the general method for checking compatibility in the social status information. There are three types of incompatibility that may occur in the information about social status. The first type is that `higher(X,Y)` is incompatible with `higher(Y,X)` or `equal_higher(Y,X)`. This type of incompatibility is detected by the predicate shown in (7.56).

(7.56)

```

compat_between_two(ConvStatLs,F,S) :-
  node_path(ConvStatLs,F,S,PathLs),
  member(higher,PathLs),
  \+ member(not_equal,PathLs),
  ( member(higher(S,F),ConvStatLs);
    member(equal_higher(S,F),ConvStatLs) ),

```



```
no
| ?-
```

Since `equal_higher(e,h)`, which can be inferred from the first three elements of the input list, is not compatible with `higher(h,e)`, the answer for the query is `no`.

The final type of incompatibility is that `equal(X,Y)` is incompatible with `higher(X,Y)`, `higher(Y,X)`, `not_equal(X,Y)`, or `not_equal(Y,X)`. The predicate illustrated in (7.60) deals with this type of incompatibility.

(7.60)

```
compat_between_two(ConvStatLs,F,S) :-
  node_path(ConvStatLs,F,S,PathLs),
  \+ member(higher,PathLs),
  \+ member(not_equal,PathLs),
  \+ member(equal_higher,PathLs),
  ( member(higher(F,S),ConvStatLs);
    member(higher(S,F),ConvStatLs);
    member(not_equal(F,S),ConvStatLs);
    member(not_equal(S,F),ConvStatLs) ),
  !,fail.
```

For instance, the query for checking the compatibility of the social status information about the two persons *j* and *m* in the list `[equal(j,k),equal(m,k),higher(m,j)]` is illustrated in (7.61) together with its output.

(7.61)

```
| ?- compat_between_two([equal(j,k),equal(m,k),higher(m,j)],j,m).
no
| ?-
```

Since `equal(j,m)`, which can be inferred from `equal(j,k)` and `equal(m,k)`, is not compatible with `higher(m,j)`, the answer for the query is `no`.

When none of the three types of incompatibility occurs in the information about the social status of two individuals, no incompatibility exists in the social status information concerning the two individuals. In order to check generally whether no incompatibility occurs in social status information, the predicate shown in (7.62) is used.

(7.62)

```
% recursive_check_compat(ConvStatLs,CombiLs) succeeds if no
```



```
% incompatibility arises with respect to any element of CombiLs
recursive_check_compat(ConvStatLs,[[F,S]]) :-
    compat_between_two(ConvStatLs,F,S),
    compat_between_two(ConvStatLs,S,F).
recursive_check_compat(ConvStatLs,[[F1,S1],[F2,S2]|Rest]) :-
    compat_between_two(ConvStatLs,F1,S1),
    compat_between_two(ConvStatLs,S1,F1),
    recursive_check_compat(ConvStatLs,[[F2,S2]|Rest]).
```

The first argument of the predicate `recursive_check_compat/2` is a Prolog list containing social status information. The second argument is a list of lists. Each list represents a possible pair of the referents that appear in the first argument. The use of all possible pairs of referents enables us to check whether no incompatibility occurs in social status information concerning any arbitrary two individuals and thus makes it possible to check compatibility generally. For example, the query for checking compatibility in the social status information contained in `[higher(s,t),equal_higher(t,w),equal(s,r),equal_higher(w,r)]` is shown in (7.63) along with the answer to the query.

```
(7.63)
| ?- recursive_check_compat([higher(s,t),equal_higher(t,w),
    equal(s,r),equal_higher(w,r)],
    [[s,t],[s,w],[s,r],[t,w],[t,r],[w,r]]).

no
| ?-
```

The reason why incompatible information exists in the input list is that `higher(r,w)`, which can be inferred from the first three elements of the list, is incompatible with `equal_higher(w,r)` that appears in the list.

When incompatibility occurs in the social status information obtained from an utterance itself, a message that conveys such a fact is produced by the predicate shown in (7.64).

```
(7.64)
informative_check_crtstatinfo_compat(UttNum,CrtStatInfoLs) :-
    create_atom_stat(CrtStatInfoLs,ConvStatLs),
    col_statrefs(ConvStatLs,RefLs),
    self_combi(RefLs,CombiLs),
    \+ recursive_check_compat(ConvStatLs,CombiLs),
    !,nl,
    write('The'),tab(1),
    print_ordinal(UttNum),
    write('utterance itself is infelicitous due to the conflicting'),
```



```

nl,
write('information about social status. '),nl,
fail.

```

The predicate `create_atom_stat/2` performs the task of replacing the Prolog variables that appear in social status information with their corresponding referents, which are Prolog atoms, based on other pieces of information extracted from a processed utterance. All possible pairs of referents are created by the predicate `self_combi/2`. The general checking of compatibility in social status information is carried out by the predicate `recursive_check_compat/2`.

When the social status information obtained from an utterance is not compatible with the social status information obtained from its preceding utterance(s), the predicate illustrated in (7.65) produces a message to that effect.

(7.65)

```

informative_check_sofarstatinfo_compat(UttNum,SofarStatInfoLs) :-
    create_atom_stat(SofarStatInfoLs,ConvStatLs),
    col_statrefs(ConvStatLs,RefLs),
    self_combi(RefLs,CombiLs),
    \+ recursive_check_compat(ConvStatLs,CombiLs),
    !,nl,
    write('The'),tab(1),
    print_ordinal(UttNum),
    write('utterance in the dialogue is infelicitous since
        information'),nl,
    write('about social status provided by the utterance is
        incompatible with'),nl,
    write('that provided by previous utterance(s). '),nl,
    fail.

```

As an example, let us look at the dialogue shown in (7.66).

(7.66) a. P-kkeyse M-kkey chengsacin-ul poyecwu-si-ess-e.
 nom (hon) dat (hon) blueprint-acc show-hon-past-dec
 ‘P showed a blueprint to M.’
 (Speaker: Youngsoo, Addressee: Sungmin)

b. Heesoo-ka M-ul manna-ss-ni?
 nom acc meet-past-int
 ‘Did Heesoo meet M?’
 (Speaker: Sungmin, Addressee: Youngsoo)

When the first utterance of dialogue (7.66) is processed, the social status information in (7.67) is obtained.

(7.67)

```
[higher(m,ys),equal_higher(p,m),equal_higher(ys,sm)]
```

When the second utterance (that is, utterance (7.66b)) is processed, the social status information in (7.68) is obtained.

(7.68)

```
[equal_higher(sm,hs),equal_higher(hs,m),equal_higher(sm,ys)]
```

The information `equal_higher(sm,m)`, which can be inferred from `equal_higher(sm,hs)` and `equal_higher(hs,m)` that appear in (7.68), is not compatible with the information `higher(m,sm)`, which can be inferred from `higher(m,ys)` and `equal_higher(ys,sm)` that appear in (7.67). This means that the social status information obtained from utterance (7.66b) is not compatible with the information about social status obtained from utterance (7.66a) and thus the dialogue in (7.66), which consists of these two utterances, is incoherent. When the query for processing dialogue (7.66) is given, the message that conveys incompatibility in social status information is produced, as shown in (7.69).

(7.69)

```
| ?- diag_mgr([[youngsoo,sungmin,p_keyse,m_key,chengsacin_ul,
                poyecwu_si_ess_e],
                [sungmin,youngsoo,heesoo_ka,m_ul,manna_ss_ni]]).
```

The 2nd utterance in the dialogue is infelicitous since information about social status provided by the utterance is incompatible with that provided by previous utterance(s).

```
no
| ?-
```

Since dialogue (7.66) is not coherent with respect to the order of social status between the person *Sungmin* and the person *M*, the representation structure of the dialogue cannot be constructed.

7.5 Resolving an Honorific Pronoun

The resolution of an honorific pronoun occurring in a dialogue is made on the basis of the social status information obtained from the dialogue.¹⁷ The main predicate for resolving an honorific pronoun is `resolve/7`, which is used in the dialogue manager shown in (7.2), and the definition of the predicate is as illustrated in (7.70).

(7.70)

```
resolve(RecovInfoLs,_,AccumUttCond,AccumStatInfo,CrtStInfo,
        SofarStInfo,ResolvInfoLs) :-
    member(pro(VarPro,PseudoRef),RecovInfoLs),
    member(speaker(VarSP,RefSP),RecovInfoLs),
    member(addressee(VarAD,RefAD),RecovInfoLs),
    create_sofarstatinfo(AccumStatInfo,RecovInfoLs,PreSofarStInfo),
    create_atom_stat(PreSofarStInfo,ConvStatLs),
    pick_higher_ref(ConvStatLs,Indx,RefSP),
    \+ Indx = RefSP,
    \+ Indx = RefAD,
    is_hi_or_eq(ConvStatLs,Indx,RefAD),
    !,
    strict_subst(pro(VarPro,PseudoRef),named(VarPro,Indx),
                RecovInfoLs,ResolvInfoLs),
    bind_samevar_across(ResolvInfoLs,AccumUttCond),
    create_crtstatinfo(ResolvInfoLs,CrtStInfo),
    create_sofarstatinfo(AccumStatInfo,CrtStInfo,SofarStInfo).
```

The social status of the referent of an honorific pronoun must be higher than that of the speaker of the utterance where the honorific pronoun occurs. To deal with this constraint the predicate `pick_higher_ref/3`, which is shown in (7.71), is used.

(7.71)

```
pick_higher_ref(ConvStatLs,Indx,RefSP) :-
    col_statrefs(ConvStatLs,RefLs),
    member(Indx,RefLs),
    node_path(ConvStatLs,Indx,RefSP,PathLs),
    \+ Indx = proind_nyk,
    member(higher,PathLs),
    \+ member(not_equal,PathLs).
```

The predicate `pick_higher_ref/3` picks up the referent whose social status is higher than that of its third argument, which stands for the speaker, based on the social status

¹⁷The discussion on how to resolve an honorific pronoun has been made in Chapter 5.

information provided by its first argument.¹⁸ For example, the query for getting the referent whose social status is higher than that of the referent *r* from the social status information in `[higher(s,k),higher(s,j),equal_higher(k,r)]` is illustrated in (7.72) along with the answer to the query.

```
(7.72)
| ?- pick_higher_ref([higher(s,k),higher(s,j),equal_higher(k,r)],
                    Ref,r).

Ref = s ? ;

no
| ?-
```

Since `higher(s,r)` can be inferred from the information in the input list, the referent *s* is picked up.

The social status of the referent of an honorific pronoun must also be higher than or equal to that of the addressee of the utterance where the honorific pronoun occurs. The predicate shown in (7.73) deals with this constraint.

```
(7.73)
is_hi_or_eq(ConvStatLs,Indx,RefAD) :-
    node_path(ConvStatLs,Indx,RefAD,PathLs),
    \+ member(not_equal,PathLs),
    ( member(higher,PathLs);
      member(equal,PathLs);
      member(equal_higher,PathLs) ).
```

The predicate `is_hi_or_eq/3` checks whether the social status of its second argument is higher than or equal to that of its third argument, which represents the addressee, based on the social status information provided by its first argument.

An honorific pronoun is a third-person pronoun and thus its referent is neither the speaker of the utterance where the honorific pronoun occurs nor the addressee. These constraints are indicated by the condition '`\+ Indx = RefSP`' and the condition '`\+ Indx = RefAD`', as shown in (7.70). Since an honorific pronoun is resolved based on social status information, the result of resolution does not give rise to incompatibility in social status information. Thus the checking of compatibility is not needed, as shown in (7.70). When a referent which satisfies the constraints on an

¹⁸Since the Prolog atom `proind_nyk` is used just as a place holder for indicating the referent of a pronoun that is not yet resolved, it cannot be the real referent of the pronoun (thus the condition '`\+ Indx = proind_nyk`' appears in the body of the predicate).

honorific pronoun cannot be found, a message is produced to that effect by the predicate shown in (7.74).

(7.74)

```
resolve(RecovInfoLs, UttNum, _, AccumStatInfo, _, _, _) :-
  member(pro(VarPro, PseudoRef), RecovInfoLs),
  member(speaker(VarSP, RefSP), RecovInfoLs),
  member(addressee(VarAD, RefAD), RecovInfoLs),
  create_sofarstatinfo(AccumStatInfo, RecovInfoLs, PreSofarStInfo),
  create_atom_stat(PreSofarStInfo, ConvStatLs),
  \+ ( pick_higher_ref(ConvStatLs, Indx, RefSP),
      \+ Indx = RefSP,
      \+ Indx = RefAD,
      \+ Indx = PseudoRef,
      is_hi_or_eq(ConvStatLs, Indx, RefAD) ),
  !, nl,
  write('The'), tab(1),
  print_ordinal(UttNum),
  write('utterance in the dialogue is infelicitous since the
        honorific'), nl,
  write('pronoun occurring in that utterance cannot be
        resolved. '), nl,
  fail.
```

The referent of an honorific pronoun must satisfy all the constraints imposed on the honorific pronoun. If such a referent is not found, the honorific pronoun cannot be resolved.

In the case where no honorific pronoun occurs in an utterance, the predicate shown in (7.75) is applied.

(7.75)

```
resolve(InfoLs, _, AccumUttCond, AccumStatInfo, CrtStInfo,
        SofarStInfo, InfoLs) :-
  \+ member(pro(_, _), InfoLs),
  bind_samevar_across(InfoLs, AccumUttCond),
  create_crtstatinfo(InfoLs, CrtStInfo),
  create_sofarstatinfo(AccumStatInfo, CrtStInfo, SofarStInfo).
```

Since an honorific pronoun does not occur, the output is the same as the input.

Let us now look at the dialogue shown in (7.76), where an honorific pronoun occurs.

(7.76) a. Choi kwacang-nim-i Han pwucang-nim-kkey
 chief section-hon-nom department director-hon-dat (hon)

chingsacin-ul ponaytuli-si-ess-e.
 blueprint-acc send (hum)-hon-past-dec
 ‘Chief section Choi sent a blueprint to department director Han.’
 (Speaker: Minho, Addressee: Sangchul)

b. Kang kwacang-nim-i Han pwucang-nim-ul poy-ess-e.
 chief section-hon-nom department director-hon-acc meet-past-dec
 ‘Chief section Kang met department director Han.’
 (Speaker: Sangchul, Addressee: Minho)

c. ㉠ Choi kwacang-nim-eykey choan-ul poyecwu-si-ess-e.
 chief section-hon-dat draft-acc show-hon-past-dec
 ‘He showed a draft to chief section Choi.’
 (Speaker: Minho, Addressee: Sangchul)

d. kupwun-kkeyse chingsacin-ul kuli-si-ess-ni?
 he/she (hon)-nom (hon) blueprint-acc draw-hon-past-int
 ‘Did he/she draw the blueprint?’
 (Speaker: chief section Kang, Addressee: Minho)

The constituent that is missing in utterance (7.76c) is found to be the same as the subject NP of its immediately preceding utterance by the predicate *recover*/5, which was discussed in the previous section. An honorific pronoun occurs in utterance (7.76d). On the basis of the social status information obtained from utterances in (7.76a)-(7.76d), the query in (7.77) is put to find the candidate for the referent of the honorific pronoun.

(7.77)

```
| ?- pick_higher_ref([higher(choi_chsc,mh),higher(han_dpdr,
    kang_chsc),equal(mh,sc),equal_higher(kang_chsc,choi_chsc),
    higher(proind_nyk,kang_chsc)],Ref,kang_chsc).
```

```
Ref = han_dpdr ? ;
```

```
no
| ?-
```

The referent *han_dpdr* is selected as the only candidate. This referent satisfies other

constraints on the honorific pronoun. In other words, all the queries in (7.78) succeed.

- (7.78) a. | ?- \+ han_dpdr = kang_chsc.
 b. | ?- \+ han_dpdr = mh.
 c. | ?- is_hi_or_eq([higher(choi_chsc,mh),higher(han_dpdr,
 kang_chsc),equal(sc,mh),equal_higher(kang_chsc,
 choi_chsc),higher(proind_nyk,kang_chsc)],han_dpdr,mh).

Thus the referent of the honorific pronoun occurring in utterance (7.76d) is the person *Han pwucang* ‘department director Han’.

7.6 Constructing the Dialogue Representation Structure

The representation structure of a dialogue contains the representation structures of the utterances occurring in the dialogue, as discussed in Chapter 4. The representation structure of an utterance is constructed on the basis of the information such as the speaker and the addressee of the utterance, the type of the utterance, the structure of the main predicate of the utterance, and the social status information obtained from the utterance. The main Prolog predicate for constructing the representation structure of an utterance is `utt_cond_gen/4`, which is used in the dialogue manager illustrated in (7.2), and the definition of the predicate is as shown in (7.79).

(7.79)

```
utt_cond_gen(RecovInfoList,AccumUttCond,UttDomName,UttCond) :-
    ( (member(type_of_utt(dec),RecovInfoList),
        functor(UttCond,say,3));
      (member(type_of_utt(int),RecovInfoList),
        functor(UttCond,inquire,3)) ),
    member(speaker(_,IndSP),RecovInfoList),
    arg(1,UttCond,IndSP),
    member(addressee(_,IndAD),RecovInfoList),
    arg(2,UttCond,IndAD),
    arg(3,UttCond,UttMsg),
    functor(UttMsg,UttDomName,2),
    organize(RecovInfoList,AccumUttCond,UttDom,UttStruct),
    arg(1,UttMsg,UttDom),
    arg(2,UttMsg,UttStruct).
```

The representation structure of an utterance takes the form of a compound term that has

three arguments.¹⁹ The functor of this term indicates the locutionary act that corresponds to the type of an utterance. The first argument and the second argument of the term stand for the speaker and the addressee of the utterance, respectively. The third argument of the term also takes the form of a compound term that takes two arguments. The functor of this compound term reflects the order of the occurrence of an utterance in a dialogue (for example, when dealing with the third utterance of a dialogue, the word `msg3` is used as the functor). The first argument of the compound term is a Prolog list consisting of variables that correspond to the referents related to an utterance. The second argument of the term is also a list containing the information about the referents related to an utterance, the structure of the main predicate of the utterance, and the social status information obtained from the utterance. This argument is built by the predicate `organize/4`, which appears in the body of the predicate shown in (7.79). Thus the rough structure of the compound term that provides the representation structure of an utterance is as illustrated in (7.80).

(7.80)

```
locutionary_act(ref_of_speaker,
                ref_of_addressee,
                msg_and_num(list_consisting_of_ref_variables,
                           list_consisting_of_utterance_contents))
```

The predicate `organize/4`, which builds the essential part of utterance representation structure, is as shown in (7.81).

(7.81)

```
organize(RecovInfoList, AccumUttCond, UttDom, UttStruct) :-
    remove(type_of_utt(_), RecovInfoList, RestRecovInfoList),
    arrange_statinfo(RestRecovInfoList, ArrangedList),
    subst(speaker(VarSP, IndSP), named(VarSP, IndSP),
          ArrangedList, MidList1),
    subst(addressee(VarAD, IndAD), named(VarAD, IndAD),
          MidList1, MidList2),
    convert_to_onearg(MidList2, ConvertedList),
    build_uttstruct(ConvertedList, AccumUttCond, UttStruct),
    collect_indvar_utt(UttStruct, UttDom).
```

By the predicate `arrange_statinfo/2`, all social status information obtained from an utterance is placed together after other information. The predicate `build_uttstruct/3` constructs the list whose elements are the contents of an utterance and

¹⁹The graphic representation structures of utterances were displayed in Section 4.2 of Chapter 4.

the content that already appears in the structures of its preceding utterances is not included in the list. For example, the information about the referent that already appears in the representation structures of the preceding utterances is excluded from the representation structure of the current utterance, even though the referent is related to the utterance. This does not cause any problem since all the referents that appear in the representation structures of the preceding utterances are available to the current utterance in the dialogue representation structure. The predicate `collect_indvar_utt/2` constructs the list whose elements are the variables that correspond to the referents which are newly introduced in an utterance.

The representation structure of a dialogue takes the form of a list that has two elements. The first element is also a list whose elements are the names of the functors of the arguments that provide the essential part of the utterance representation structure. The second element is also a list consisting of the representation structure of each utterance occurring in a dialogue. As an example, let us look at the representation structure of the dialogue shown in (7.82).

- (7.82) a. Choi kwacang-i Chung cenmwu-kkey selyu-lul
 chief-section-nom executive director-dat (hon) document-acc
 tuli-ess-ni?
 give (hum)-past-int
 'Did chief-section Choi give a document to executive director Chung?'
 (Speaker: W, Addressee: J)
- b. e Han pwusacang-nim-kkey e tuli-ess-eyo.
 vice president-hon-dat (hon) give-past-dec (hon)
 'He gave it to vice president Han.'
 (Speaker: J, Addressee: W)

When the first utterance of dialogue (7.82) is processed, the interim representation structure of the dialogue is as shown in (7.83).

- (7.83)
- ```
[[msg1],
 [inquire(w, j, msg1([A, B, C, D, E],
 [named(A, w), named(B, j), named(C, choi_chsc),
 named(D, chung_exdr), docu(E),
 main_pred(give_hm, C, D, E)],
```

```
equal_higher(A,C),higher(D,A),
equal_higher(A,B)))]]
```

After the second utterance, which is the final utterance of the dialogue, is processed, the final representation structure of the dialogue, which is illustrated in (7.84), is obtained.

(7.84)

```
[[msg1,msg2],
 [inquire(w,j,msg1([A,B,C,D,E],
 [named(A,w),named(B,j),named(C,choi_chsc),
 named(D,chung_exdr),docu(E),
 main_pred(give_hm,C,D,E),
 equal_higher(A,C),higher(D,A),
 equal_higher(A,B)])),
 say(j,w,msg2([F],
 [named(F,han_vpres),main_pred(give_hm,C,F,E),
 higher(F,B),equal_higher(F,A),equal_higher(B,C),
 not_equal(B,A)]))]]
```

Whenever an utterance of a dialogue is processed, the structure representing the utterance is added to the interim representation structure of the dialogue. After all utterances occurring in a dialogue are processed, the representation structure of the dialogue is obtained. Thus the dialogue representation structure is built incrementally and compositionally.

## 7.7 Computing Social Status Information

When no incompatibility occurs in the social status information obtained from a dialogue, the order of social status is computed based on that information. The main Prolog predicate for computing the order of social status is `compute_socstat/2`, which is illustrated in (7.85).

(7.85)

```
compute_socstat([SocStat],SocStat) :- !.
compute_socstat([StatInfoLs1,StatInfoLs2|RestStatInfo],SocStat) :-
 append(StatInfoLs1,StatInfoLs2,StatInfoAccum),
 delete_argvar_dupli(StatInfoAccum,SocStatMid1),
 delete_not_eq_dupli(SocStatMid1,SocStatMid2),
 compu_sofarstatinfo(SocStatMid2,SocStatMid3),
 compute_socstat([SocStatMid3|RestStatInfo],SocStat).
```

The first argument of the predicate is a list consisting of the pieces of social status information obtained from each utterance of a dialogue. The second argument is also a list containing the result that is obtained by computing the order of social status based on the information in the first argument. The computation of the order of social status is carried out by the predicate `compu_sofarstatinfo/2`, which is shown in (7.86).

(7.86)

```
compu_sofarstatinfo(PreSofarStInfo,SofarStInfo) :-
 infer_higher(PreSofarStInfo,SofarStInfoMid1),
 infer_equal(SofarStInfoMid1,SofarStInfoMid2),
 select_informative_type1_twice(SofarStInfoMid2,SofarStInfoMid3),
 select_informative_type1(SofarStInfoMid3,SofarStInfoMid4),
 select_informative_type2(SofarStInfoMid4,SofarStInfoMid5),
 select_informative_type3(SofarStInfoMid5,SofarStInfoMid6),
 delete_rdnsofar_type1_eqhg_twice(SofarStInfoMid6,SofarStInfoMid7),
 delete_rdnsofar_type1_eqhg(SofarStInfoMid7,SofarStInfoMid8),
 delete_rdnsofar_type1_hg_twice(SofarStInfoMid8,SofarStInfoMid9),
 delete_rdnsofar_type1_hg(SofarStInfoMid9,SofarStInfoMid10),
 delete_rdnsofar_type2(SofarStInfoMid10,SofarStInfoMid11),
 delete_rdnsofar_type2_eq(SofarStInfoMid11,SofarStInfoMid12),
 delete_rdnsofar_type3(SofarStInfoMid12,SofarStInfoMid13),
 delete_rdnsofar_type4(SofarStInfoMid13,SofarStInfo).
```

The order of social status is computed by following three types of procedures. The first type of procedure is to infer a new relation from the existing two relations and remove the existing relations. For example, `equal(X,Y)` is inferred from `equal_higher(X,Y)` and `equal_higher(Y,X)`, as shown in (7.87).

(7.87)

```
infer_equal(Ls1,Ls2) :-
 member(equal_higher(VarEqH1,VarEqL1),Ls1),
 member(equal_higher(VarEqH2,VarEqL2),Ls1),
 VarEqH2 == VarEqL1,
 VarEqL2 == VarEqH1,
 !,
 strict_subst_var2(equal_higher(VarEqH1,VarEqL1),
 equal(VarEqH1,VarEqL1),Ls1,Ls2Mid),
 remove_comp(equal_higher(VarEqH2,VarEqL2),Ls2Mid,Ls2).
infer_equal(Ls,Ls).
```

If such relations do not occur in the input list, the output list is the same as the input list.

The second type of procedure is to choose the more informative relation between two existing relations. For instance, if both `higher(X,Y)` and `equal_higher(X,Y)` occur in the input list, the less informative relation (that is, `equal_higher(X,Y)`) is

removed from the input list, as illustrated in (7.88).

(7.88)

```
select_informative_type1(Ls1,Ls2) :-
 member(higher(VarH,VarL),Ls1),
 member(equal_higher(VarEqH,VarEqL),Ls1),
 VarEqH == VarH,
 VarEqL == VarL,
 !,
 remove_comp(equal_higher(VarEqH,VarEqL),Ls1,Ls2).
select_informative_type1(Ls,Ls).
```

The final type of procedure is to remove redundant relations. For example, if `equal_higher(X,Z)` (or `higher(X,Z)`) occurs in the input list along with `higher(X,Y)` and `equal_higher(Y,Z)`, the redundant relation `equal_higher(X,Z)` (or `higher(X,Z)`) is removed from the input list, as shown in (7.89).

(7.89)

```
delete_rdnsofar_type1_eqhg(Ls1,Ls2) :-
 member(higher(VarH1,VarL1),Ls1),
 member(equal_higher(VarEqH1,VarEqL1),Ls1),
 VarEqH1 == VarL1,
 !,
 remove_comp(higher(VarH1,VarEqL1),Ls1,Ls2Mid),
 remove_comp(equal_higher(VarH1,VarEqL1),Ls2Mid,Ls2).
delete_rdnsofar_type1_eqhg(Ls,Ls).
```

Let us now consider how to compute the order of social status on the basis of the social status information shown in (7.90).

(7.90)

```
[equal_higher(A,C),higher(D,A),equal_higher(A,B),higher(D,B),
 equal_higher(D,A),equal_higher(B,C),not_equal(B,A)]
```

By the procedure of inferring a new relation, `higher(A,B)` is inferred from `equal_higher(A,B)` and `not_equal(B,A)` and then the two existing relations are removed. After this procedure, we get the list illustrated in (7.91).

(7.91)

```
[equal_higher(A,C),higher(D,A),higher(A,B),higher(D,B),
 equal_higher(D,A),equal_higher(B,C)]
```

The procedure of choosing the more informative relation between two existing

relations causes `higher(D,A)` to be chosen (namely, causes `equal_higher(D,A)` to be removed from the list in (7.91)). After this procedure, the list shown in (7.92) is obtained.

(7.92)

```
[equal_higher(A,C), higher(D,A), higher(A,B), higher(D,B),
 equal_higher(B,C)]
```

By the procedure of removing a redundant relation, `equal_higher(A,C)` is removed from the list in (7.92) (since `higher(A,B)` and `equal_higher(B,C)` exist) and `higher(D,B)` is also removed (since `higher(D,A)` and `higher(A,B)` exist). Thus we finally get the list shown in (7.93).

(7.93)

```
[higher(D,A), higher(A,B), equal_higher(B,C)]
```

The social status information in (7.93) is the result of computing the order of social status provided by the social status information in (7.90). This result is supported by the output of the query for computing the order of social status with regard to (7.90), as illustrated in (7.94).

(7.94)

```
| ?- compu_sofarstatinfo([equal_higher(A,C), higher(D,A),
 equal_higher(A,B), higher(D,B),
 equal_higher(D,A), equal_higher(B,C),
 not_equal(B,A)], StatLs).
StatLs = [higher(D,A), higher(A,B), equal_higher(B,C)] ? ;
no
| ?-
```

## 7.8 Summary

The dialogue manager takes charge of processing dialogue. We make systematic use of information about dialogue participants and information about social status in processing dialogue since those pieces of information are needed for dealing with dialogue appropriately. The components of the dialogue manager are: the utterance parser based on an HPSG grammar implemented in ALE, the extractor of information relevant to dialogue representation, the component of recovering omitted constituents

in dialogue, the resolver of honorific pronouns, the generator of a dialogue representation structure, and the calculator of the order of social status for the individuals involved in dialogue.

When we parse an utterance of a dialogue using ALE, the contextual information as well as the structural information related to the utterance is available. From this information we extract all information needed to construct the dialogue representation structure. We recover constituents that are missing in an utterance and resolve honorific pronouns that occur on the basis of the information extracted from the utterance and the information obtained from its preceding utterances. Thus we utilize a flow of information among utterances. If a missing constituent cannot be recovered or an honorific pronoun cannot be resolved due to incompatibility in social status information, a message is produced to that effect. After missing constituents are recovered and honorific pronouns are resolved, the representation structure of an utterance is constructed. In the representation structure of an utterance the following information is included: the type of the utterance, the speaker and the addressee of the utterance, the contents of the message conveyed by the utterance, and the relative order of the social status of the individuals involved in the utterance. The representation structure of an utterance is added to the interim dialogue representation structure which consists of the representation structures of preceding utterances. This interim dialogue representation structure enables us to use information coming from previous utterances in processing a current utterance. When all utterances occurring in a dialogue have been processed and no incompatibility occurs in the social status information obtained from them, the dialogue manager produces the representation structure of the dialogue and the order of the social status of the individuals involved in the dialogue. If a dialogue is found to be incoherent owing to incompatibility in social status information obtained from the dialogue, the dialogue manager presents the reason for incoherence instead of the representation structure of the dialogue. Therefore, the dialogue manager we have implemented successfully models dialogue processing by dealing with phenomena occurring in a dialogue and producing the representation structure of the dialogue only when the dialogue is coherent.

In the next chapter we suggest future work that would further extend and develop what we have achieved in this thesis.



## Chapter 8

### Directions for Future Research

In this chapter we consider a number of issues which may be the topics of future research. We consider how to deal with the spreading of honorification to nonhuman entities, how to recover missing constituents in complex utterances that contain a subordinate clause or an embedded clause, and how to cope with the problem of undergeneration. In addition, the issue of using social status information in application areas such as generation of Korean dialogue is discussed.

#### 8.1 Treatment of Honorification Spreading

Although honorification is related to people, there are cases where honorification spreads to an entity which is physically inalienable from a person (for example, the person's body parts such as eyes, forehead, and hands) or to an entity which is mentally inalienable from a person (for instance, the person's thoughts or hometown). As an example, let us consider the utterance in (8.1).

- (8.1) Y-nim-uy        sayngkak-i        olh-usi-ni?  
         hon-gen    thoughts-nom    right-hon-int  
         'Are Y's thoughts right?'  
         (Speaker: H, Addressee: W)

In utterance (8.1) the person *Y* is honoured by the speaker. Since thoughts of *Y* are mentally inalienable from him, they are also honoured, as indicated by the honorific infix occurring in the predicate of the utterance. Thus in order for honorification to spread to a nonhuman entity, two conditions should be satisfied. One condition is that the person who is related to the entity must be honoured by the speaker. The other condition is that the entity must be inalienable from the honoured person. For example, honorification does not spread in the utterance shown in (8.2) since both conditions are not met.

- (8.2) J-nim-uy    koyangi-ka    nalssay-ni?  
          hon-gen    cat-nom    nimble-int  
          'Is J's cat nimble?'  
          (Speaker: K, Addressee: P)

The cat which is owned by the person *J* is not inalienable from that person, who is honoured by the speaker. Consequently, the spreading of honorification from the honoured person to his cat does not occur in utterance (8.2).

When honorification spreads from the person honoured by the speaker to the entity which is inalienable from him, an honorific morpheme can appear only in the predicate that describes the inalienable entity. In other words, an honorific morpheme cannot attach directly to the inalienable entity. This means that the utterance shown in (8.3) is not allowed.

- (8.1) Y-nim-uy    sayngkak-kkeyse    olh-usi-ni?  
          hon-gen    thoughts-nom (hon)    right-hon-int  
          'Are Y's thoughts right?'  
          (Speaker: H, Addressee: W)

The difference between utterance (8.1) and utterance (8.3) is that the honorific nominative case marker *kkeyse* attaches to the inalienable entity in the latter utterance. Thus there arises a discrepancy between the spreading of honorification and the use of an honorific morpheme. In order to deal with utterances where spreading of honorification occurs, we may think that when a component of an NP contains an honorific morpheme and an inalienable relation holds between the components of the NP, the whole NP is honoured by the speaker even though an honorific case marker does not attach to that NP. The task of how to embody and implement this idea is left for future work.

## 8.2 Recovery of Missing Constituents in Complex Utterances

Most utterances in naturally occurring dialogue consist of a single clause.<sup>1</sup> Complex utterances, which contain an embedded clause or a subordinate clause as well as the main clause, however, sometimes appear in dialogue and a constituent may be omitted in the embedded clause. As an example, let us take a look at the complex utterance shown in (8.4).

- (8.4) H-ka [e saken-ul mokyekha-yess-tako] mit-ni?  
 nom accident-acc witness-past-comp believe-int  
 'Does H believe that he/she witnessed the accident?'  
 (Speaker: L, Addressee: M)

In utterance (8.4), the subject NP of the embedded clause is omitted. If the context of the utterance is not taken into account, the referent of the missing subject NP is the same as that of the subject NP of the main clause. On the other hand, let us consider the dialogue shown in (8.5), where utterance (8.4) appears as (8.5b).

- (8.5) a. W-ka wuyenhi saken hyencang-ul cinaka-ss-eyo.  
 nom by chance accident spot-acc pass by-past-dec (hon)  
 'W happened to pass by the spot of the accident.'  
 (Speaker: M, Addressee: L)
- b. H-ka [e saken-ul mokyekha-yess-tako] mit-ni?  
 nom accident-acc witness-past-comp believe-int  
 'Does H believe that he/she witnessed the accident?'  
 (Speaker: L, Addressee: M)

The referent of the constituent which is missing in the embedded clause of utterance (8.5b) is that of the subject NP of its preceding utterance (that is, utterance (8.5a)) rather than the subject referent of the main clause in the same utterance. Thus

<sup>1</sup>In our corpus of spoken dialogues, among the total number of 291 utterances, 262 utterances contain just a single clause. Thus 90% of utterances appearing in the corpus are simple utterances composed of only a main clause.

depending on the context in which a complex utterance occurs, the referent of the constituent that is missing in the utterance varies. Furthermore, when more than one constituent is missing in a complex utterance, it is more difficult to recover those missing constituents. For example, a constituent may be omitted both in the main clause and in an embedded clause, as shown in (8.6).

- (8.6) ☉ [☉ R-ul manna-ss-tako] malha-yess-supnikka?  
           acc meet-past-comp   say-past-int (hon)  
       ‘Did ☉ say that ☉ met R?’ (literally)  
       (Speaker: S, Addressee: J)

According to the context in which utterance (8.6) occurs, the referent of the constituent omitted in the main clause may be the same as or different from that of the missing constituent in the embedded clause. The task of finding a general way to recover missing constituents in complex utterances would be an interesting part of future work.

### 8.3 Overcoming Undergeneration

When a person who is mentioned in an utterance is not honoured by the speaker, but the addressee is honoured by the speaker, there are two possibilities with regard to the order of social status between the speaker and the person mentioned. One case is that the social status of the person is definitely not higher than that of the speaker. The other case is that the social status of the person is higher than that of the speaker, but is lower than that of the addressee. The reason why the latter case may be applicable is that when the social status of the addressee is higher than that of the person mentioned in an utterance, the speaker cannot show honour to that person even though the social status of the person is higher than that of the speaker himself. Our current implementation extracts social status information based on the morphemes used in an utterance and thus it cannot account for this delicate situation. As an example, let us look at the dialogue shown in (8.7).

- (8.7) a. H-ka      choan-ul    caksengha-yess-e.  
           nom    draft-acc    make out-past-dec

'H made out a draft.'

(Speaker: K, Addressee: R)

b. S-ka      chengsacin-ul      kuli-ess-eyo.  
       nom    blueprint-acc    draw-past-dec (hon)

'S drew a blueprint.'

(Speaker: R, Addressee: K)

From utterance (8.7a) we can certainly infer that the social status of the person *H* is not higher than that of the speaker *K* since the social status of the addressee is not higher than that of the speaker. On the other hand, when we process utterance (8.7b) from left to right, we first infer that the social status of the person *S* is not higher than that of the speaker *R* from the use of the nonhonorific case marker. Only after we process the whole utterance, can we infer that the social status of the person *S* may be higher than that of the speaker, based on the fact that the social status of the addressee is higher than that of the speaker. This latter inference can be made not by relying on the morphemes used, but by taking into account other relevant pieces of information about social status.<sup>2</sup> The use of real world knowledge, which is beyond the scope of this thesis, would make it possible to perform such subtle inferences and thus is left to

---

<sup>2</sup>Our implementation, which depends on morphemes in order to extract social status information, provides the information shown in (a) with regard to the dialogue in (8.7).

- (a) i.  $K \geq H$                     (from utterance (8.7a))  
       ii.  $R \geq S$ ,  $K > R$         (from utterance (8.7b))

From the occurrence of addressee honorification and non-occurrence of subject honorification in utterance (8.7b), there arises the possibility that the relation  $S > R$  may also be valid. Thus an ideal system will extract the information shown in (b) from dialogue (8.7).

- (b) i.  $K \geq H$                     (from utterance (8.7a))  
       ii.  $R \geq S$  or  $S > R$ ,  $K > R$     (from utterance (8.7b))

The reason the relation  $S > R$  may also be derived from utterance (8.7b) is that even though the social status of the subject referent *S* is higher than that of the speaker *R*, the speaker cannot show honour to him (thus a nonhonorific nominative case marker is used, as in the utterance) when the social status of the addressee is higher than that of the subject referent. Consequently, the best possible inference about the order of social status between *S* and *R* from the use of a nonhonorific nominative case marker and an honorific verbal ending in utterance (8.7b) is ' $R \geq S$  or  $S > R$ ', essentially no information, rather than  $R \geq S$ .

When an utterance which follows utterance (8.7b) indicates that the relation  $S > R$  is valid, the relation  $R \geq S$  will be discarded by the ideal system. In this situation, however, our implementation is not so flexible and thus it judges that such a dialogue is incoherent due to conflicting information (that is,  $R \geq S$  and  $S > R$ ).

future research.

## 8.4 Application to Generation of Korean Dialogue

Depending on the order of the social status of the individuals involved in a Korean dialogue, the form of utterances occurring in the dialogue varies. This means that to generate Korean dialogues appropriately, we have to take into account such contextual information. As an example, let us consider the dialogue shown in (8.8).

- (8.8) a. Did H watch the play?  
(Speaker: P, Addressee: Y)
- b. Yes, he did.  
(Speaker: Y, Addressee: P)
- c. Did he say that it was amusing?  
(Speaker: P, Addressee: Y)

In dialogue (8.8) three individuals (that is, *P*, *H*, and *Y*) are involved. In the situation where the order of social status shown in (8.9) holds, the Korean dialogue that corresponds to English dialogue (8.8) should be as illustrated in (8.10).

- (8.9)  $H > P > Y$

- (8.10) a. H-kkeyse      yenkuk-ul      po-si-ess-ni?  
                  nom (hon)    play-acc    watch-hon-past-int
- b. yey,                    ③      po-si-ess-eyo.  
                  yes (hon),      watch-hon-past-dec (hon)
- c. ③ [yenkuk-i    hungmiiss-ess-tako]    malssumha-si-ess-ni?  
                  play-nom    amusing-past-comp    say (hon)-hon-past-int

The honorific morphemes appearing in dialogue (8.10) reflect social status information and English pronouns are realized as missing constituents. On the other hand, when



the information about social status illustrated in (8.11) is valid, the Korean dialogue that is generated must be as shown in (8.12), not as shown in (8.10).

(8.11)  $P=Y>H$

(8.12) a. H-ka      yenkuk-ul      po-ass-ni?  
               nom      play-acc      watch-past-int

b. ung,      ☹      po-ass-e.  
               yes,      watch-hon-past-dec

c. ☺ [yenkuk-i      hungmiiss-ess-tako]      malha-yess-ni?  
               play-nom      amusing-past-comp      say-past-int

Thus, in order to generate Korean dialogue appropriately, we have to make good use of social status information. If such information is not considered, a generated dialogue would be very awkward since it cannot capture the context in which a dialogue takes place. Dialogue generation is involved in areas such as machine translation of dialogues and systems for human-machine dialogues. For example, in machine translation of English dialogues into Korean dialogues, social status information must be taken into account to generate a dialogue which is relevant to a given situation.<sup>3</sup> We leave to a topic of future research the task of how to represent and exploit such contextual information so that an appropriate dialogue can be generated.

## 8.5 Summary and Discussion

To deal with honorification spreading we need to use the knowledge of whether an inalienable relation holds between a possessor and its possessed entities. Since this relation is not indicated by lexical items appearing in an utterance, we should depend

---

<sup>3</sup>In English dialogues, social status information is sparsely provided, though the word *sir* or titles used in utterances could be helpful. If we generate a Korean dialogue on the assumption that all individuals involved in an English dialogue have equal social status, the generated dialogue would be relevant only to limited situations (for instance, a situation in which conversations occur between friends). To obtain social status information from English dialogues to the full extent, we must depend on other sources as well as linguistic terms.



on real world knowledge to determine such relations. The recovery of missing constituents in complex utterances is more difficult than that of missing constituents in simple utterances. According to the context in which a complex utterance occurs, the referents of missing constituents in the utterance are determined. In this case real world knowledge plays an important role. Our system of dialogue processing also cannot extract one of two possible orders of social status when addressee honorification occurs, but subject or object honorification does not occur in an utterance. This undergeneration may lead to an incorrect judgement about dialogue coherence. To cope with that kind of undergeneration real world knowledge is again needed. The appropriate generation of a Korean dialogue requires information about the social status of the individuals involved in the dialogue. When social status information is not provided by linguistic expressions used in a dialogue, we have to use real world knowledge to extract such information.

Therefore, we need real world knowledge more or less to give a complete account of honorification, the recovery of missing constituents in all types of utterances, the extraction of all possible social status information, and the generation of relevant dialogues. Although our system does not use real world knowledge, it works quite well in processing Korean dialogues on the basis of various kinds of linguistic information (for example, syntactic, semantic, and contextual information) obtainable from dialogues.

Our current system does not deal with variations of word order (Korean is relatively free in the order of words appearing in an utterance) and does not consider whether word order has an effect on the recovery of missing constituents. In addition, the system does not treat quantification and does not look into whether interactions occur between honorification and quantification. These areas are also left to future work.

## Chapter 9

### Conclusions

Dialogues are held between people. Various kinds of information are provided by utterances appearing in a dialogue. In order for a dialogue to be a coherent unit, there must be no incompatibility resulting from honorification and underlying social status information obtained from the dialogue. This information is also helpful in explaining other linguistic phenomena occurring in dialogues. Thus to process dialogues properly, we have to keep track of such information from utterance to utterance and use it effectively.

In this thesis we have investigated the processing of Korean dialogue using morphological, syntactic, semantic, and pragmatic information concurrently. Unlike English dialogue, in Korean dialogue, the phenomenon of honorification occurs, honorific pronouns may be used, and whole constituents are frequently omitted when they can be recovered from context. We have shown that making systematic use of contextual information such as information about dialogue participants and social status information about the people involved in dialogue is essential to the appropriate processing of Korean dialogue. Accordingly, in Korean dialogue such information is crucial and must be utilized fully.

Every Korean utterance indicates whether or not honorification occurs. We demonstrated that the occurrence of honorification in an utterance is constrained by the order of the social status of all the individuals involved in the utterance (namely, the speaker, the addressee, and the persons mentioned in the utterance). We observed that it is possible to extract social status information based on specific morphemes used in an utterance. Depending on the context in which an utterance is used, the types of honorification that can occur in the utterance are determined. When honorification does not occur appropriately and thus incompatibility arises in the social status information obtained from an utterance within a dialogue context, we judge that the utterance is infelicitous.

Since we can easily incorporate contextual information within the framework of HPSG, we adopted that framework in the processing of utterances occurring in a

dialogue. The contextual information provided by the lexical items appearing in an utterance is percolated to the utterance level by appropriate principles. When an utterance has been processed and no incompatibility arises in the contextual information, we can determine the context where the utterance is felicitous.

We showed how to construct the representation structure of dialogue incrementally and compositionally by modifying DRT. In *dialogue* representation structures we included information about the form of each utterance, dialogue participants, and the order of the social status of the people involved in dialogue as well as syntactic and semantic information provided by each utterance of dialogue. By using a structure which represents the contents of the message conveyed by an utterance as a dialogue referent, we observed that the information obtained from an utterance can naturally be made available to subsequent utterances. Based on this mechanism of information flow it is possible to recover constituents that are missing in dialogue, to resolve honorific pronouns, and to check whether or not a dialogue is coherent.

An honorific pronoun always refers to a person and honorific morphemes attach only to an NP referring to a human entity. These facts may tempt us to use the simple method that identifies the referent of an honorific pronoun with the referent of the NP to which an honorific morpheme attaches. This naive method, however, is effective only when a dialogue is held between two fixed persons. The method does not work correctly when more than two persons participate in a dialogue. We showed that the use of social status information about the individuals involved in a dialogue leads to a correct resolution of an honorific pronoun regardless of the number of participants in a dialogue.

In naturally occurring Korean dialogue, constituents of an utterance are omitted if they are recoverable. Even in the initial utterance of a dialogue a constituent may be omitted. The candidate for the referent of a constituent missing in an utterance is the speaker or the addressee of the utterance or an entity mentioned in preceding utterances. We observed that though centering theory works in the resolution of anaphora in discourse, it cannot be straightforwardly applied to the recovery of missing constituents in dialogue, where the speaker and the addressee may change from utterance to utterance. We presented an algorithm that makes use of the following information: the form of an utterance, information about the subject NP or the object NP of an utterance, information about preceding utterances, and social status information. We showed that the algorithm recovers missing constituents in naturally occurring dialogues with high accuracy.

The computational model we have implemented reflects a way to process Korean dialogue. It keeps track of crucial information obtainable from dialogue and makes use of information flow among utterances to deal with linguistic phenomena that occur in dialogue. The model produces the representation structure of a dialogue only when it is found to be coherent. In the case where a dialogue is incoherent, the model gives a reason for its incoherence.

To our knowledge, no existing work has treated the three linguistic phenomena (namely, honorification, the phenomenon of omitting constituents, and the use of honorific pronouns) simultaneously that occur in everyday Korean dialogue, still less has implemented a computational model to process it. This thesis sets a new direction for processing Korean dialogue in that it takes into account dialogue participants and utilizes crucial information in judging the coherence of dialogue. We hope that the method of processing Korean dialogue would be flexible enough to be applied to the processing of Japanese dialogue (where the phenomenon of honorification occurs and constituents can be omitted) or Chinese dialogue (where constituents may be missing, though honorification does not occur) without substantial modification.

# References

- Asher, Nicholas (1993). *Reference to Abstract Objects in Discourse*. Kluwer Academic Publishers, Dordrecht.
- Asher, Nicholas and Alex Lascarides (1994). Intentions and Information in Discourse. In *Proceedings of the 32nd Annual Meeting of the Association for Computational Linguistics*, 34-41, Las Cruces, NM.
- Bratko, Ivan (1990). *Prolog Programming for Artificial Intelligence*. Second Edition. Addison-Wesley Publishing Company, Reading, MA.
- Brennan, Susan E., Marilyn W. Friedman, and Carl J. Pollard (1987). A Centering Approach to Pronouns. In *Proceedings of the 25th Annual Meeting of the Association for Computational Linguistics*, 155-162, Stanford, CA.
- Carberry, Sandra (1990). *Plan Recognition in Natural Language Dialogue*. The MIT Press, Cambridge, MA.
- Carletta, Jean (1992). *Risk-taking and Recovery in Task-Oriented Dialogue*. Unpublished Doctoral Dissertation, Department of Artificial Intelligence, University of Edinburgh. Also available at the web site, <http://www.cogsci.ed.ac.uk/~jeanc/>.
- Carpenter, Bob (1992). *The Logic of Typed Feature Structures: With Application to Unification Grammars, Logic Programs and Constraint Resolution*. Cambridge Tracts in Theoretical Computer Science 32. Cambridge University Press, Cambridge.
- Carpenter, Bob and Gerald Penn (1995). ALE (Attribute Logic Engine) Version 2.0.1 (available at the web site, <http://macduff.andrew.cmu.edu/ale/> or by anonymous ftp from <ftp://ftp.cs.cmu.edu/user/ai/lang/prolog/code/parsing/ale/>).
- Cho, Choon-Hak (1982). *A Study of Korean Pragmatics: Deixis and Politeness*. Doctoral Dissertation, Department of Linguistics, University of Hawaii. Available from Hanshin Publishing Company, Seoul.
- Clocksin, William F. and Christopher S. Mellish (1987). *Programming in Prolog*. Third, Revised and Extended Edition. Springer-Verlag, New York, NY.
- Covington, Michael A. (1994). *Natural Language Processing for Prolog Programmers*. Prentice Hall, Englewood Cliffs, NJ.
- Dowty, David R (1979). *Word Meaning and Montague Grammar: The Semantics of Verbs and Times in Generative Semantics and in Montague's PTQ*. D. Reidel Publishing Company, Dordrecht.
- Dowty, David R., Robert E. Wall, and Stanley Peters (1981). *Introduction to Montague Semantics*. D. Reidel Publishing Company, Dordrecht.



- Gal, Annie, Guy Lapalme, Patrick Saint-Dizier, and Harold Somers (1991). *Prolog for Natural Language Processing*. John Wiley & Sons, New York, NY.
- Gazdar, Gerald and Chris Mellish (1989). *Natural Language Processing in Prolog: An Introduction to Computational Linguistics*. Addison-Wesley Publishing Company, Reading, MA.
- Grosz, Barbara J. (1977). The Representation and Use of Focus in a System for Understanding Dialogs. In *Proceedings of the Fifth International Joint Conference on Artificial Intelligence (IJCAI-77)*, 67-76, Cambridge, MA. Also appears in Barbara J. Grosz, Karen Sparck Jones, and Bonnie Lynn Webber, editors, *Readings in Natural Language Processing*, 353-362. Morgan Kaufmann Publishers, Los Altos, CA.
- Grosz, Barbara J. and Candace L. Sidner (1986). Attention, Intentions, and the Structure of Discourse. *Computational Linguistics* 12, 175-204.
- Grosz, Barbara J. and Candace L. Sidner (1990). Plans for Discourse. In Philip R. Cohen, Jerry Morgan, and Martha E. Pollack, editors, *Intentions in Communication*, 417-444. The MIT Press, Cambridge, MA.
- Grosz, Barbara J., Aravind K. Joshi, and Scott Weinstein (1995). Centering: A Framework for Modeling the Local Coherence of Discourse. *Computational Linguistics* 21, 203-225.
- Han, Eunjoo (1991). Honorification in Korean. Unpublished Manuscript. Stanford University.
- How, Khee-Yin (1993). *A Processing Framework for Temporal Analysis and its Application to Instructional Texts*. Unpublished Doctoral Dissertation, Department of Artificial Intelligence, University of Edinburgh.
- Johnson, Mark. (1988). *Attribute-Value Logic and the Theory of Grammar*. CSLI Lecture Notes Number 16. Center for the Study of Language and Information (CSLI), Stanford, CA.
- Kamp, Hans (1981). A Theory of Truth and Semantic Representation. In Jeroen Groenendijk, Theo Janssen, and Martin Stokhof, editors, *Formal Methods in the Study of Language*, 277-322. Mathematical Centre, Amsterdam.
- Kamp, Hans and Uwe Reyle (1993). *From Discourse to Logic: Introduction to Modeltheoretic Semantics of Natural Language, Formal Logic and Discourse Representation Theory*. Kluwer Academic Publisher, Dordrecht.
- Kim, Yong-Bum (1988). *A Fragment of Korean Phrase Structure Grammar*. Doctoral Dissertation, Department of Linguistics, University of Victoria. Available from Hanshin Publishing Company, Seoul.
- Kuno, Susumu and Young-Joo Kim (1985). The Honorific Forms of Compound Verbals in Korean. In Susumu Kuno, John Whitman, Ik-Hwan Lee, and Young-Se Kang, editors, *Harvard Studies in Korean Linguistics*, 178-189. Hanshin Publishing Company, Seoul.

- Lascarides, Alex (1995). *The Handout on SDRT and DICE* (distributed in the class of Theoretical Linguistics II: Semantics), Centre for Cognitive Science, University of Edinburgh.
- Lascarides, Alex and Nicholas Asher (1991). Discourse Relations and Defeasible Knowledge. In *Proceedings of the 29th Annual Meeting of the Association for Computational Linguistics (ACL-91)*, 55-63, Berkeley, CA.
- Lascarides, Alex, Nicholas Asher, and Jon Oberlander (1992). Inferring Discourse Relations in Context. In *Proceedings of the 30th Annual Meeting of the Association for Computational Linguistics (ACL-92)*, 1-8, Newark, DE.
- Lascarides, Alex and Nicholas Asher (1993). A Semantics and Pragmatics for the Pluperfect. In *Proceedings of the 6th Conference of the European Chapter of the Association for Computational Linguistics (EACL-93)*, 250-259, Utrecht.
- Lascarides, Alex and Jon Oberlander (1993). Temporal Connectives in a Discourse Context. In *Proceedings of the 6th Conference of the European Chapter of the Association for Computational Linguistics (EACL-93)*, 260-268, Utrecht.
- Lee, Dong-Young (1996a). An HPSG Account of the Korean Honorification System. In Claire Grover and Enric Vallduví, editors, *Edinburgh Working Papers in Cognitive Science*, Volume 12: Studies in HPSG, 165-190, Centre for Cognitive Science, University of Edinburgh.
- Lee, Dong-Young (1996b). Computation of Relative Social Status on the Basis of Honorification in Korean. In *Proceedings of the Sixteenth International Conference on Computational Linguistics (COLING-96)*, 693-698, Copenhagen.
- Levinson, Stephen C. (1983). *Pragmatics*. Cambridge University Press, Cambridge.
- Litman, Diane J. and James F. Allen (1990). Discourse Processing and Commonsense Plans. In Philip R. Cohen, Jerry Morgan, and Martha E. Pollack, editors, *Intentions in Communication*, 365-388. The MIT Press, Cambridge, MA.
- Martin, Samuel and Young-Sook Lee (1969). *Beginning Korean*. Yale University Press, New Haven, CT.
- Montague, Richard (1974). *Formal Philosophy: Selected Papers of Richard Montague*. Edited and with an Introduction by Richmond H. Thomason. Yale University Press, New Haven, CT.
- O'Keefe, Richard A. (1990). *The Craft of Prolog*. The MIT Press, Cambridge, MA.
- Park, Byung-Soo (1991). The Semantic and Pragmatic Nature of Honorific Agreement in Korean: An Information-Based Approach. Unpublished Manuscript. Kyung Hee University.
- Pereira, Fernando C.N. and Stuart M. Shieber (1987). *Prolog and Natural-Language Analysis*. CSLI Lecture Notes Number 10. Center for the Study of Language and Information (CSLI), Stanford, CA.



- Poesio, Massimo (1994). *Discourse Interpretation and the Scope of Operators*. Doctoral Dissertation, Department of Computer Science, University of Rochester.
- Poesio, Massimo (1995). A Model of Conversation Processing Based on Micro Conversational Events. In *Proceedings of the Annual Meeting of the Cognitive Science Society*, Pittsburgh, PA.
- Poesio, Massimo and David Traum (1995). A Multi-Purpose Model of Conversational Context. In *Proceedings of the IJCAI Workshop on Context and Knowledge Representation*, Montreal.
- Pollack, Martha E. (1986). A Model of Plan Inference that Distinguishes between the Beliefs of Actors and Observers. In *Proceedings of the 24th Annual Meeting of the Association for Computational Linguistics (ACL-86)*, 207-214, New York, NY.
- Pollard, Carl and Ivan A. Sag (1994). *Head-Driven Phrase Structure Grammar*. The University of Chicago Press, Chicago, and Center for the Study of Language and Information (CSLI), Stanford, CA.
- Searle, John R. (1969). *Speech Acts: An Essay in the Philosophy of Language*. Cambridge University Press, Cambridge.
- Searle, John R. (1979). *Expression and Meaning: Studies in the Theory of Speech Acts*. Cambridge University Press, Cambridge.
- Shieber, Stuart M. (1986). *An Introduction to Unification-Based Approaches to Grammar*. CSLI Lecture Notes Number 4. Center for the Study of Language and Information (CSLI), Stanford, CA.
- Sidner, Candace L. (1983). Focusing in the Comprehension of Definite Anaphora. In Michael Brady, and Robert C. Berwick, editors, *Computational Models of Discourse*, 267-330. MIT Press, Cambridge, MA. Also appears in Barbara J. Grosz, Karen Sparck Jones, and Bonnie Lynn Webber, editors, *Readings in Natural Language Processing*, 363-394. Morgan Kaufmann Publishers, Los Altos, CA.
- Sperber, Dan and Deirdre Wilson (1986). *Relevance: Communication and Cognition*. Harvard University Press, Cambridge, MA.
- Sterling, Leon and Ehud Shapiro (1994). *The Art of Prolog*. Second Edition. The MIT Press, Cambridge, MA.
- Suh, Chung-Soo (1978). Remarks on Subject Honorification. In Chin-Wu Kim, editor, *Papers in Korean Linguistics*, 297-304. Hornbeam Press, Columbia, SC.
- Walker, Marilyn, Masayo Iida, and Sharon Cote (1994). Japanese Discourse and the Process of Centering. *Computational Linguistics* 20, 193-232.
- Yeh, Ching-Long and Chris Mellish (1994). An Empirical Study on the Generation of Zero Anaphors in Chinese. In *Proceedings of the Fifteenth International Conference on Computational Linguistics (COLING-94)*, 732-736, Kyoto.

# Appendix A

## Transcripts of Real Spoken Dialogues

\*\*\*\*\*

### Dialogue over the Phone about Learning a Foreign Language

\*\*\*\*\*

*Audience:* ㄷ icey-nun-yo chelcehi hay-yo. waynyahamye-nun-yo ㄷ ttalakal swu-ka eps-e-yo.

*Presider A:* kulehci-yo. sensayng-nim-i ku nal mwe hoycholi an tul-ess-eyo?

*Audience:* ㄷ hoycholi-nun an tul-ko-yo, kkwucilam-i acwu taytanha-sye-yo.  
(laughs)

*Presider A:* a, kulesey-yo?

*Audience:* yey.

*Presider B:* Cho Jungsoon haksayng, ㄷ ilayto ai-tul kac-ko tulpokk-ul ke-pnikka? (laughs)

*Presider A:* kulay-yo, ㄷ cikum hanmwun han sikan ilpone han sikan ha-si-n-ta-ko-yo?

*Audience:* yey.

*Presider A:* ㄷ ilpone sillyek-un kulem enu cengto-na toy-sey-yo?

*Audience:* cikum mak kicho iakana-hako kanakana oywu-kosenun, ta-tul cikum myech kwa naka-ss-eyo.

*Presider A:* a, kuleh-syess-kwun-yo.

*Audience:* yey.

*Presider B:* kulentey isscyanha-yo, [ㄷ nai tul-ese kongpwuha-nikka-nun], cohun cem-to iss-ko nappun cem-to iss-cyo?

*Audience:* yey.

*Presider B:* ney, cohun cem-un mwe-pnikka?

*Audience:* cohun cem-un-yo, chayk-ul saypyek-pwuthe po-ko ka-ss-ta wa-se-to kongpwuha-ko cengsin katatum-nun-key koyngcanghi coh-a-yo. kuliko han ca-lato nam-pota te an-ta-nun-key. ilehkey television-eyse-yo, cepen-ey nolay-ka nao-nuntey, ilpone-lo ilehkey penyekhay-se nao-tela-ko-yo, sopangcha nolay-ka. kuntay-yo, ㄷㄹ ㄷㄹ taychwungun ttaylye cap-a-se al swu iss-ul kes kath-ey-yo. (laughs)

*Presider B:* ttaylye cap-a-se. (laughs)

*Audience:* kulenikka ㄷㄹ ta paywu-myen coh-ta al-keyss-cyanh-a-yo.

*Presider B:* paywe-se nam cwu-nya.

*Audience:* yey.

*Presider A:* kulentey chinkwu-tul-i-yo, Cho Jungsoon-ssi chinkwu-pwun-tul-i, ani, ㄷㄹ towa-cwu-ci-nun moshal-mangceng (laughs) saym-i koyngcanghi manhi na-si-na pwa-yo. kulaykaciko, ani, nam cikum kongpwuha-le ka-keyss-ta-nuntey, san-ulo tul-lo palam ssoy-le ta-ni-ci, mwusun meli ssul il-i iss-na-myen-se-yo. (laughs)

*Audience:* yey, kolchi aphu-key mwe chayk tulye-po-ko anc-ass-nunya-ko-yo. (laughs) [ㄷㄹ namwul ttut-ule ka-ca-ko wa-se cakkwu pochay-kaci-ko], [ㄷㄹ ka-ss-eyo, ithul tongan].

*Presider A:* ㄷㄹ mostoy-syess-ta. (laughs)

*Presider B:* kuntay-yo, [ㄷㄹ akka cohun cem malssumha-syess-nuntey], ku himtu-si-nun cem com malssum hay-cwu-sey-yo. ku himtu-nun ke.

*Audience:* himtu-nun ke-yo?

*Presider B:* ney.

*Presider A:* himtu-si-nun-kes manhun kes kath-untey.

*Audience:* kuntay-yo, ㄷㄹ cakkwu ic-e-mek-e-yo.

*Presider B:* kuleh-ci-yo.

*Audience:* ㄷㄹ pap mek-ko tolase-myen ic-e-mek-ko. kulenikka, ㄷㄹ nam han-pen hal kes twu-pen hay-ya toy-yo.

*Presider B:* ney. ㄷㄹ chayksang meli-ey anc-a kyey-sil sikan-i com manhaci-si-nunkwun-yo?

*Audience:* yey.

*Presider A:* i paywu-nun kes-to ta ttay-ka iss-ta-ko kule-nuntey, [ㄷㄹ kongkamha-si-cyo]?

*Audience:* yey.

*Presider B:* ney. [ᵇᵇ kyeysoxhay-se i kongpwu-nun acwu kkuthkkaci [ᵇᵇ ilpon  
sosel chayk ilk-ul-ttay-kkaci] kongpwuha-sil ke-pnikka]?

*Audience:* yey. [ᵇᵇ ikel ttay-myen kipun-ul ttay-myenun], [ᵇᵇ naynyen-ey han-  
pen incey tto cwungkup-pan-ulo tulekal-lye-ko kulay-yo].

*Presider A:* aha.

*Presider B:* ᵇᵇ uyyok-i taytanha-si-pnita.

*Presider A:* ᵇᵇ hanmwun sillyek-un enu cengto toysey-yo, hanmwun?

*Audience:* hanmwun-i-yo? hanmwun-un [ᵇᵇ pwulphyenhay-se sayongha-nikkan],  
elyep-ci anh-nuntey-yo, ilpone-nun com sayngsoha-tela-ko-yo.

*Presider A:* kuleh-ci-yo?

*Audience:* ney.

*Presider A:* yey.

*Audience:* ilpone-ka te elyewe-yo.

*Presider B:* ney. oykwuke-nun-yo, cakkwu-man cacwu hal swulok nun-ta-ko  
kule-nuntey. kulem, [ᵇᵇ honca pap ha-si-myense ilehkey kelleycil chi-  
si-myense], [ᵇᵇ honca com silkhes ilpone-lul com hay po-si-ci kule-  
si-pnikka]? (*laughs*)

*Audience:* yey. ᵇᵇ cikum-to theyiphu-lul thul-e noh-ko hwacangsil-ey aph-ey-ta-  
ka sse noh-ko-senun pwuthi-ko kulay-yo.

*Presider A:* mac-a-yo, mac-a-yo. palo kuke-ey-yo.

*Presider B:* sikkwu-tul-i mwe-lako kule-si-nuntey-yo?

*Audience:* yey, ᵇᵇ cakkwu kyeklyehay-cwu-cyo.

*Presider B:* calhan-ta-ko, calhan-ta-ko.

*Audience:* yey.

*Presider A:* mal-i eps-telayto cwungel cwungel kulayya-ci, kulayya-ci meli-ey  
tuleo-pnita.

*Audience:* yey.

*Presider A:* ca, com yoksim-pwulye-se kaci-ko-yo, cakyekcung hanpen tta-sey-yo.

*Audience:* yey.

*Presider A:* ilpone thongyek.

*Presider B:* thongyek, tongsì thongyek.

*Presider A:* kulekil pala-keyss-supnita, Cho Jungsoon-ssi.

*Audience:* yey.

*Presider A:* saylo tancanghan Yoido Garden yeysikcang-eyse Hong Pouy-ssi-lako,  
(*laugh*) tongswusan-phwum yelmay senmwul-lo cwunpihay-ss-supnita.

*Audience:* yey, kamsaha-pnita.

*Presider B:* ney, kamsaha-pnita.

*Audience:* swukoha-sey-yo.

*Presider B:* kongpwu calha-sey-yo.

----- *end of dialogue* -----

\*\*\*\*\*

### Dialogue about Memorable Travels

\*\*\*\*\*

*Presider:* [<sub>ᄃ</sub> ku ttay pwumo-nim-tul-hako caki uyci-ey uyhayse ka-n kes ani-  
ntey], [<sub>ᄃ</sub> pwumo-nim-tul-hako eti eti-lul tanye-syess-ten-kes kath-ey-  
yo]?

*Attendee A:* [ce-uy apenim-i tungsan cohaha-sye-kaciko-yo], [<sub>ᄃ</sub> ta ka po-ass-  
supnita].

*Presider:* selaksan, cilisan...

*Attendee A:* kulen san ppwun-man-i ani-ko ccokuman san...

*Presider:* pwukhansan, topongsan, kwanaksan, [<sub>ᄃ</sub> ta ka po-si-ko-yo]?

*Attendee A:* swulisan, paykpong, [[<sub>ᄃ</sub> ka po-n] tey-ka manh-ci-yo].

*Presider:* o, [<sub>ᄃ</sub> manhi tani-syess-ney-yo, ney. [<sub>ᄃ</sub> san-ey ka-nikka], [mwe-ka  
coh-ten-ka-yo]?

*Attendee A:* [<sub>ᄃ</sub> ku ttay-nun cham himtul-ess-eyo. [<sub>ᄃ</sub> himtul-ess-nuntey], [<sub>ᄃ</sub>  
[ce-uy apenim-i ce-lul teyli-ko tani-si-n] iyu-lul al-keyss-eyo].

*Presider:* way-yo?

*Attendee A:* [<sub>ᄃ</sub> yocum tul-e-kaciko cengmal com meymalu-ta-nun sayngkak-ul

manhi kac-ke-tun-yo.

*Presider:* ney.

*Attendee A:* cey casin-to kuleh-ko. kulentey, ku ttay sice-i manhi wian-i toy-nun-kes kath-ey-yo.

*Presider:* ney.

*Attendee A:* [e<sub>3</sub> ku ttay sayngkak-ul ha-myense], [[tto kkok tungsan-i ani-telayto e<sub>3</sub> tohoyci-na tosimso-  
ul tani-myense ttus-to molu-ko emma soncap-ko ta-nyess-ten] ku ttay-uy ku nukkim-tul ku yengsang-tul-i sayngkakhay-po-myen sayngkakhay-pol-swulok alumtawun-kes-tul-i manh-ass-ten-kes kath-ey-yo].

*Presider:* ney, kulenikka ku elinsice-ey kacok-hako-uy chwuek, koyngcanghi cithkey nam-a iss-nun-kes kath-ey-yo. wuli ce, Yoo Ikjong-ssi, kacang kiek-ey nam-nun yehayng-un?

*Attendee B:* kulssey-yo, [akka-to e<sub>3</sub> malssumtuli-ess-ci-man], [yehayng-un pyello cey-ka cohaha-ci-anh-ase cal tanyepo-ci-n anh-ass-nuntey], [[amwulayto e<sub>3</sub> tayhakkyo cheum tuleka-ko nase caki ttan-ey-nun com sengin-i toy-ess-ta-ko sayngkakha-l ttay] ku ttay nol-le-ka-ss-ten-key kacang kiek-ey nam-nun-kes kath-ey-yo].

*Presider:* e<sub>3</sub> ku ttay eti ka-syess-eyo?

*Attendee B:* kicha tha-ko ku eti-ci, cikum kapcaki sayngkak-i an na-nun-tey.

*Presider:* ney, yaykihay po-sey-yo.

*Attendee B:* Choonchun-ccok-ul kapo-myen iss-ci-yo, Yangsooli cina-se Kamchon-se te ka-se. [e<sub>3</sub> chinkwu-tul-ilang kathi peynang-ul mey-ko cheum kotunghakkyo-lul colepha-ko-nase cheum ka-ss-ul-ttay-intey], [ku ttay-ka acik pheynanhay-ss-ten maum-ilase kulenci ku ttay-ka ceyil kiek-ey nam-nun-kes kath-ey-yo].

*Presider:* kulem, e<sub>3</sub> namca chinkwu-tul-hako-man ilehkey ka-ss-ess-na-yo?

*Attendee B:* ani-ci-yo. (laughs)

*Presider:* Oh, yeca chinkwu-ka iss-ess-eyo?

*Attendee B:* kulehcyo. ku ken cakkey yaykiha-cyo.

*Attendee C:* sinhon yehayng-un e<sub>3</sub> eti-lo ka-ss-eyo? (laughs)

*Presider:* Yim Jeehoon-ssi-hako Yoo Ikjong-ssi-hako-uy kwankyey-ka cenghwakhi ettehkey toy-pnikka?

*Attendee C:* yey? e<sub>3</sub> senhwupay sai-intey-yo, il nyen chai pakkey antway-yo.

ce-nun sinhon yehayng-i kwungkumhay-yo, Yoo Ikjong-ssi.

*Presider:* ney, kulemyen ko yayki-nun twu-pwun-i ttalo mannase tapang-eyse ha-si-ko, wuli tongmwulwen-uy nolay hankok chenghay tut-keyss-supnita. nolay ceymok-i 'pyenhay ka-nei'-cyo?

*Several People* yey.

*Presider:* sey-pwun-uy moksoli hamkkey tut-keyss-supnita. pakswu cwu-si-cyo.

(after they sing a song)

*Presider:* kulentey ku key ku mosup-i-yo, cey-ka ilehkey po-nikka acwu insangcek-i-nkey wis ipswul alays ipswul acwu an tamwul-ko kitha-lul mak chi-si-ko. mwullon nolayha-sil ttayn incey ip-ul pellyese nolayha-yess-ci-manun, ku mosup-i cham insangcek-i-nkey koyngcanghi swunpakha-si-n-kes kath-ey-yo. [ㄷ ilen yayki tul-umyen], [ㄷ com sswuksulewu-si-cyo]?

*Attendee B:* ㄷ cohun yayki-i-nkes kath-supnita.

*Attendee C:* cikum kkaci-yo kitha-lul kyeysok cey-ka chye-ss-ess-ke-tun-yo. [ㄷ onul kitha incey chil-lyeko ilehkey maum-ul cap-nun-kes kath-ase], [cey-ka kyengkyey-lul hay-ss-ke-tun-yo]. [ㄷ kincang-ul ha-ko mak yelcengcekulo kulayse te chi-n-kes kath-ey-yo].

*Presider:* ㄷ "na-to Pay Yongkil-ssi-mankhum chil-swu iss-ta" ilen kipwun-ulo chyess-na-po-cyo?

*Attendee B:* ㄷ olaynmaney hanpen chi-ko siph-e chye pwass-nun-tey yeksi chi-nikka coh-nei-yo, kitha. (laughs)

*Presider:* kulentey cikum nolay-ka 'pyenhay ka-nei'-intey, [ㄷ [choykuney sey-pwun-hanthey mwusun pyenhwa-ka iss-ess-ta-nun] yayki-l tul-ess-eyo]. ponlaynun sey-pwun ta cikcang saynghwal-ul ha-syess-nun-tey, mwe pyenhwa-ka iss-ess-ta-myense-yo?

*Attendee B:* ney, thukhi yeki cikum kkuth-ey iss-nun Park Keeyong-kwun-i-yo wenlay D group-ey ta-ni-ta-ka, tongmwulwen umak-ey te cennyemha-ki wihayse simsimhan sauy-lul phyoha-ko cikum umak-ey cennyemha-ko iss-supnita].

*Presider:* hoysa-ccok-eyse simsimhan sauy phyoha-n key ani-ko-yo? kawuntay iss-nun Bae Yongkil-ssi, a, iken mwe yetam-i-pnita-manun, ㄷ Bae Yongman-ssi-hako-nun etten kwankyey-ka ani-si-n-ka?

*Attendee D:* ㄷ ku yayki-lul koyngcanghi manhi tut-nun-tey-yo. ku khomidien Bae Yongman-ssi-lang-un ce-lang-un cenhye sangkwan-i eps-nun-tey-yo, ce-uy hyeng-nim ilum-i Bae Yongman-ssi-ey-yo, chin hyeng-nim ilum-i-yo.



*Presider:* a, chin hyeng-nim ilum-i Bae Yongman-ssi.

*Attendee D:* yey. kulayse ㄹ hyengcey kwankyey-i-pnita, Bae Yongman-ssi-lang-un.

*Presider:* chin hyeng-nim-hako ku Bae Yongman-ssi-hako manna-myen cham caymiiss-keyss-ney-yo. onul ce-lang ce twi-ey kenpanchi-si-nun Chung Jaewhan-ssi-lang manna-n kes-chelem.

*(laughs together with some unclear and mixed utterances by attendees)*

*Presider:* onul 'san tulnyek pata'-lanun cwucey-lo yayki nanwu-ko nolay tut-ko iss-nun-tey-yo. wuli, ce, Park Keeyong-ssi-ka icey ponkyekcekulo nolay-lul sicakha-yess-ta-ko kulay-ss-nun-tey, cokum akka wuli chwuek-uy yehayng yaykiha-l ttay Park Keeyong-ssi-man yayki-lul an ha-n-kes kath-ey-yo.

*Attendee E:* a, ce-yo? a, ce-nun Chejooto-i-pnita.

*Presider:* a, Chejooto, ney. ㄹ cacwu ka-sey-yo?

*Attendee E:* yey.

*Presider:* kuleh-supnikka? ㄹ encey cheum ka-syess-eyo?

*Attendee E:* [[ㄹ cheum ka-n-ke-nun] sa-nyen-cen-pakk-ey an toy-ess-ketun-yo]. kulentey [ㄹ hanpen ka-nikka], ya, [[wulinala ttang-ey-to ilen tey-ka iss-ta-nun-key cham chwukpok-i-kwuna hanun] sayngkak-i tul-te-lakwu-yo].

*Presider:* Chejooto cham alumtap-cyo?

*Attendee E:* yey.

*Presider:* san-to noph-ko.

*Attendee E:* yey.

*Presider:* ce-to Chejooto-lul cham cohaha-nuntey, [ㄹ hoksi nacwung-ey Chejooto kath-un tey ka-se sal-ko siph-un sayngkak eps-u-sey-yo]?

*Attendee E:* ㄹ iss-eyo.

*Presider:* Oh, kulay-yo?

*Attendee E:* yey.

*Presider:* ce-lang ceng pwuticchil-cito molu-keyss-kwun-yo. *(laugh from Attendee E)* ca, ipen-ey kyeysokhay-se Yim Jeehoon-ssi-uy nolay-lul com chenghay tut-keyss-supnita.

----- end of dialogue -----

\*\*\*\*\*

**Dialogue in a Soap Opera Titled  
“palam-un pwul-eto” ‘Although the Wind Blows’**

\*\*\*\*\*

*Son:* apeci, ㄹㄱ ce pwulu-syess-eyo?

*Father:* kulay. [ㄹㄱ ka-se poni-kkani], [ney emeni mikkuleci-key-to sayngkyess-ta]. mwul swu-e-se kulen-ci, [ㄹㄱ pancil pancil-hakey el-ess-e].

*Son:* yey, keki-ka kunul-i cye kaci-ko-se mwul-i hulu-myen cal el-eyo, cal nok-ci-to anh-ko-yo.

*Father:* kulekey mal-i-ta. swusilo ney-ka sap-ulo ㄹㄴ com kulk-e-nwa.

*Son:* ney, ㄹㄱ kulel-kkey-yo, apeci.

*Father:* ku yenthansap iss-u-myen coh-keyss-nunten mal-i-ya. Kyunghee emeni mikkuleci-ci anh-tolok cosimha-lako kulay, ung. kuliko swusilo ney-ka twikyeth-ulo kapwa, ung.

*Son:* yey, cey-ka cikum ka-se sap-ulo ㄹㄴ kkaykkusi chiwe noh-ul-kkey-yo. apeci, kekcengha-ci ma-sey-yo.

*Father:* ung.

--- (Change of Scene) ---

*Daughter:* ㄹㄱ com ettay, emma.

*Mother:* ㄹㄱ ccimcilha-ko na-ss-teni hankyel pwutulep-ta-ya. Kyunghee emi, ㄹㄱ ayssess-ta.

*Kyunghee's mother:* cosimha-sey-yo, emeni. (*Kyunghee's mother goes out*)

*Daughter:* na-to ollakal-kkey, emma. [ㄹㄱ iltan cwumwu-si-ko na-se nayil achim-ey-to kyeysok aphu-myen], [ㄹㄱ pyengwen ka-se chwalyeng hanpen hay pwa-ya toyl-keyey-yo]. hoksi ppye kum-ilato ka-ss-nun-ci molu-nikka.

*Mother:* kum ka-n-kes kath-ci-nun anh-ta-ya. tahayng-i-ta-ya. (*laugh*)

*Father:* a, wusum-to nao-keyss-ta. (*coming in the room*)

*Mother:* a, wus-ci-yo, kulem wul-eyo? a, Sunmee-ya, ney swukmo tul-e-o-syess-ta-ni?

*Daughter:* yey.

*Mother:* com kenne-o-si-lako kulay-la. ani-ya, toy-ss-ta-ya, ɛ<sub>s</sub> nayil ɛ<sub>n</sub> po-ci-mwe.

*Daughter:* swi-sey-yo, kulem.

*Mother: kulay. (daughter goes out)*

*Father:* ceyswu-ssi-nun, wa?

*Mother:* ㄹ onul halwu congil elkwul-ul mos po-ass-teni, po-ko siph-ese-yo.

*Father:*  $\text{e}_s$  manhi aphe?

*Mother:* [e<sub>3</sub> pyengwen ka-l cengto-nun ani-nikka], kekcengha-ci ma-sey-yo. [e<sub>3</sub> yencho-pwuthe naksang-ul hay-ss-u-ni], ol hanhay wunswu-nun ponama-keyss-ne-yo. aikwu, heli-ya.

*Father:* cosim com ha-ci anh-kose, eikwu. [e<sub>3</sub> po-nikka], [e<sub>3</sub> mikkuleci-key sayng-kyess-cyanh-a]. [e<sub>3</sub> kaseto mal-i-ya cosimseng eps-key kkangchong kkangchong kunyang kuleko tani-nikka], [e<sub>3</sub> mikkulecyess-ci], mwe. wunswu thalyeng-un mwusun wunswu-ya.

*Mother:* aikwu, nay-ka mwusun thokki-ey-yo? kkangchong kkangchong-ha-ko  
taynki-key?

*Father:* [ᵀ thokki-na toy-myenun], [ᵀ kwiyeᵑki-na ha-ci].

*Mother:* ai, chi, tangsin-un siktang acwumma-tul-hanthey inki kkul-myense cikwen-tul-hako hoysik hal ttay-yo, manwula-nun cip-eyse saykki-tul wihayse kimchi kkenay-taka elumphan-ey nemecyess-eyo. aikwu, ettehkey pwupwu-ka ilehkey talul swu-ka iss-tey-yo?

*Father:* ilen, ③ kkwayna khunil hayss-kwumen. ③ canghay kulay.

*Mother:* chi.

--- (Change of Scene) ---

*Husband:* ehyu, ㄹ sap-ulo taykang elum kulk-e-nay-ko hulk-ulo teph-ess-ney.  
icey ㄹ an mikkulewul-keya, icey.

*Wife:* keki-ka kuleh-tako-yo. na-to ce pen-ey hamathemyen nemecil ppen hayss-e.

*Husband:* cosim-hay, kyewul-ey tachi-myen an coh-a, tangsin-to. ceki, cham, kulentey akka Sunmee-ka way kulenun-ke-ya?

*Wife:* ai, mwe-ka thecye-se kulenun-ci akassi-ka tongsayng-hanthey com kulenun  
nwunchi-telakwu.

*Husband:* Sunmee-ka ceyswu-ssi-hantey? way? twul-i chinhay-ss-cyanh-a.

*Wife:* kulssey, ㄷ kule-nun-kes kath-ayss-nuntey, ai mwe hayethun com kulay-ss-eyo. [hal mal iss-e-to], [ㄷ selo an macwuchi-ko yongken-man ttak malha-ko hoching-tul-to an pwulu-ko].

*Husband:* Sunmee-ka enni-lako an hay?

*Wife:* ung, akassi-ka enni-lako-to an pwulu-ko. tongse-to akassi-lako an pwulu-ko. kuleteni, emeni-ka tongse-ney kimchi kkenay cwu-si-taka nemeci-si-nikka, akassi-ka tululan-tusi hansoli-hatey.

*Husband:* mwe-lako?

*Wife:* mwe, emeni-ka ilen kes-kkaci hay-ta pachye-ya toy-nunya, son-i eps-na pal-i eps-na-myen-se.

*Husband:* Sunmee koke an toy-keyss-nuntey. ㄷ encey hanpen ㄷ honnaycwe-ya-keyss-e.

*Wife:* eyu, kule-ci mal-a-yo. kulen il-un tangsaca-tul-kkili cektanghan kihoy-ka toy-se phwu-nun-key nas-ci. kwaynhi yeph-eyse ilayla celayla ha-myenun kanceng-man te akhwatoyl swu iss-ta-ko.

*Husband:* ani, maychin-key iss-ta-myenun tangsaca-tul-kkili phwu-nun-ken elmatunci coh-un-tey, kulayto kiponcekin yeyuy-nun kacchwue-yaci. ci-ka eti sonwi olkhey-hanthey hal soli an hal soli ta-hay. kuliko ㄷ kkaktusi enni-lako hay-yaci. way hoching-i eps-e. kulen-ken teylye-taka ilpwule-lato kaluchye-ya toy. ani, kuliko ssawul ttay ssawu-telato kiponcekin kes-un kacchwue-yaci. yeyuy-to epsi ku key mwe-ya.

*Wife:* aikwu, kuleta kwaynhi akassi-hako tangsin-hako-man isanghay-cye. tangsin-i akassi-hanthey mwe-lako haypwa-yo. emeni tto kipwun an coh-u-sil-theyko. a, kuman twe.

*Husband:* a, mwe kulenke kepna-se mal mos-hay. calmosha-n ke-nun calmosha-n ke-ci. kuliko ceyswussi-to calmosha-n ke iss-u-myen tangsin-to al-a-se yayki-hay cwe-yaci.

*Wife:* a, na-nun kuleko siph-ci anh-a-yo. ta-tul al mankhum a-nun elun-tul-i-ko tto cey sayngkak-i iss-nun salam-tul-i-ntey, mol-lase molu-nun-kes kath-u-myenunya il-le cwul swu-to iss-ci-man ta nalum-taylo phantanhay-se hayngtongha-nun kel, nay-ka yeph-eyse eccekwu ceccekwu ha-myen ku-key cansoli-pakk-ey te toy-yo? kapcaki inkyek-i pakkwi-e-yaci.

*Husband:* eyikwu, kulenikka [ㄷ maynnal [ㄷ mwulu-ta-nun] soli-na tut-ci].

*Wife:* nwu-ka nal mwulu-tay?

*Husband:* kulay.

*Wife:* nwu-ka?

*Husband:* tangsin siapeci, cangnam-i.

*Wife:* cham, aikwu. na kathun salam-i cengmal hwa hanpen nay-myen elmana mwusewun-ci molu-napwa, Hwang Sunhae-ssi.

*Husband:* an-ta, an-ta, an-ta. cal nass-e, tangsin. (*laughs*)

--- (*Change of Scene*) ---

*Grandmother:* ca, wuli kangaci, ellun tulenwu-we. olhci. (*her daughter comes in*)  
 ㄷㄹ cam an ca-ko way o-nun ki-ye?

*Mother:* kunyang.

*Grandmother:* yay, i poilla kkecin-kes ani-tani?

*Mother:* ㄷㄹ an kkecyess-e.

*Grandmother:* ani, pang-i way ili ssellengha-ko chwup-tani? aiko, wuli kangaci kamki kelli-keyss-ney. aiko chwu-we, aiko chwu-we. pangpatak com pwa. pangpatak-i salam tek pol-lyeko kulye. hwu hwu, i pwa-la. elmana chwuwu-myen ip-eyse yenki-ka nao-n-tanya. pang-ey-ta mwul tte noh-u-myen kkang-kkang el-keyss-e.

*Mother:* emma-nun kkok salam wulhwathong theci-key malha-nun mwe iss-tela.

*Grandmother:* nay-ka mwe.

*Mother:* molla.

*Grandmother:* aiko, ne kulehkey cakkwu aymi-hanthey thwulthwulkeli-ci mal-e.  
 [ㄷㄹ iss-ul ttay], [ㄷㄹ cal hay-cwe].

*Mother:* ㄷㄹ tto eti kal-lakwu?

*Grandmother:* kulye. [ney-ka cakkwu emi mal-kuth-ey thwulthwulkule-ssa-myen],  
 [ㄷㄹ kal-ke-ye].

*Mother:* ㄷㄹ eti kal-lakwu? kal-tey-nun iss-kwu?

*Grandmother:* way eps-e, na kal-tey seyss-e. na o-lako yengkam thangkwa-tul-i cwul sess-tanuntey.

*Mother:* ey ey ey, chi. (*laughs*)

*Grandmother:* aiko tto nwun kam-ko cam-ina ca po-ca. etten yengkam thangkwa-tul-i kitali-ko iss-nun-ka. aiko chwu-we.

----- end of dialogue -----

# Appendix B

## Sample Runs of Dialogue Processing

### • Dialogue 1

```
=====
a. @ tokile-lul paywu-ni?
 German-acc learn-int
 'Do YOU learn German?'
 (Speaker: Sohee, Addressee: GM)

b. @ cwungkwuke-lul paywe-yo.
 Chinese-acc learn-dec(hon)
 'I learn Chinese.'
 (Speaker: GM, Addressee: Sohee)

c. cwungkwuke mwuncang-i kantanha-ni?
 Chinese sentence-nom simple-int
 'Is Chinese sentence simple?'
 (Speaker: Sohee, Addressee: GM)

d. @ pokcapha-yeyo.
 complex-dec(hon)
 'It is complex.'
 (Speaker: GM, Addressee: Sohee)
=====

| ?- diag_mgr([[gm,sohee,e,tokile_lul,paywu_ni],
 [sohee,gm,e,cwungkwuke_lul,paywe_yo],
 [gm,sohee,cwungkwuke_mwuncang_i,kantanha_ni],
 [sohee,gm,e,pokcapha_yeyo]]).

--- Dialogue Representation Structure:
[[msg1,msg2,msg3,msg4],
 [inquire(gm,sh,msg1(
 [A,B,C],
 [named(A,gm),named(B,sh),named(C,german),
 main_pred(learn,B,C),
 equal_higher(A,B)])),
 say(sh,gm,msg2(
 [D],
 [named(D,chinese),
 main_pred(learn,B,D),
 not_equal(B,A)])),
 inquire(gm,sh,msg3(
 [E],
 [chns_sent(E),main_pred(simple,E),
 equal_higher(A,B)])),
 say(sh,gm,msg4(
 [],
```

```
[main_pred(complex,E),
 not_equal(B,A))]]]]
```

```
--- Relative Order of Social Status:
[higher(A,B)]
```

```
Further Solution? y.
```

```
no
| ?-
```

## • Dialogue 2

```
=====
a. @ kinyem tongcen-ul sa-ss-e.
 commemoration coin-acc buy-past-dec
 'I bought a commemorative coin.'
 (Speaker: Junghoon, Addressee: Wonkil)

b. Wonkil-a, @ tongcen-ul mou-ni?
 voc coin-acc collect-int
 'Wonkil, do you collect coins?'
 (Speaker: Junghoon, Addressee: Wonkil)

c. @ wuphyo swucip-ul culki-e.
 stamp collection-acc enjoy-dec
 'I enjoy collecting stamps.'
 (Speaker: Wonkil, Addressee: Junghoon)

d. ollimphik kinyem wuphyo-ka nawass-e.
 Olympic commemoration stamp-nom came out-dec
 'Olympic commemorative stamp was issued.'
 (Speaker: Wonkil, Addressee: Junghoon)

e. @ @ sa-ss-e.
 buy-past-dec
 'I bought it.'
 (Speaker: Wonkil, Addressee: Junghoon)

f. Minchul-a, @ yelsoy koli-lul mou-ni?
 voc key ring-acc collect-int
 'Minchul, do you collect key rings?'
 (Speaker: Junghoon, Addressee: Minchul)

g. @ sengnyangkap-ul moa.
 matchbox-acc collect(dec)
 'I collect matchboxes.'
 (Speaker: Minchul, Addressee: Junghoon)
=====

| ?- diag_mgr([[junghoon,wonkil,e,kinyem_tongcen_ul,sa_ss_e],
 [junghoon,wonkil,wonkil_a,e,tongcen_ul,mou_ni],
 [wonkil,junghoon,e,wuphyo_swucip_ul,culki_e],
 [wonkil,junghoon,ollimphik_kinyem_wuphyo_ka,
 nawass_e],
```



```
[wonkil,junghoon,e,e,sa_ss_e],
[junghoon,minchul,minchul_a,e,yelsoy_koli_lul,
 mou_ni],
[minchul,junghoon,e,sengnyangkap_ul,moa]]).
```

--- Dialogue Representation Structure:

```
[[msg1,msg2,msg3,msg4,msg5,msg6,msg7],
 [say(jh,wk,msg1(
 [A,B,C],
 [named(A,jh),named(B,wk),
 comcn(C),main_pred(buy,A,C),
 equal_higher(A,B)])),
 inquire(jh,wk,msg2(
 [D],
 [cn(D),main_pred(collect,B,D),
 equal_higher(A,B)])),
 say(wk,jh,msg3(
 [E],
 [stmpc(E),main_pred(enjoy,B,E),
 equal_higher(B,A)])),
 say(wk,jh,msg4(
 [F],
 [olycomstmp(F),main_pred(come_out,F),
 equal_higher(B,A)])),
 say(wk,jh,msg5(
 [],
 [main_pred(buy,B,F),
 equal_higher(B,A)])),
 inquire(jh,mc,msg6(
 [G,H],
 [named(G,mc),
 kyr(H),main_pred(collect,G,H),
 equal_higher(A,G)])),
 say(mc,jh,msg7(
 [I],
 [mtchbx(I),main_pred(collect,G,I),
 equal_higher(G,A)])))]]
```

--- Relative Order of Social Status:

```
[equal(A,B),equal(A,G)]
```

Further Solution? y.

```
no
| ?-
```

### • Dialogue 3

```
=====
a. Koo sacang-nim-i Kang kwacang-i pokose-lul
 president-hon-nom chief-section-nom report-acc
caksengha-yess-tako mit-usi-eyo.
write out-past-comp believe-hon-dec(hon)
'President Koo believes that chief-section Kang wrote out a
report.'
(Speaker: YK, Addressee: PS)
```

b. @ pokose-lul ilk-usi-ess-ni?  
 report-acc read-hon-past-int  
 'Did he read the report?'  
 (Speaker: PS, Addressee: YK)

c. @ @ ilk-usi-ess-eyo.  
 read-hon-past-dec  
 'He read it.'  
 (Speaker: YK, Addressee: PS)

=====

```
| ?- diag_mgr([yk,ps,koo_sacang_nim_i,kang_kwacang_i,pokose_lul,
 caksengha_yess_tako,mit_usi_eyo],
 [ps,yk,e,pokose_lul,ilk_usi_ess_ni],
 [yk,ps,e,e,ilk_usi_ess_eyo])).
```

--- Dialogue Representation Structure:

```
[[msg1,msg2,msg3],
 [say(yk,ps,msg1(
 [A,B,C,D,E],
 [named(A,yk),named(B,ps),named(C,koo_pres),
 named(D,kang_chsc),
 rpt(E),refer(F,pred(write_out,D,E)),
 main_pred(believe,C,F),
 higher(C,A),equal_higher(C,B),equal_higher(A,D),
 not_equal(A,B))]),
 inquire(ps,yk,msg2(
 [],
 [main_pred(read,C,E),
 higher(C,B),equal_higher(B,A)])),
 say(yk,ps,msg3(
 [],
 [main_pred(read,C,E),
 higher(C,A),equal_higher(C,B),not_equal(A,B)])))]]
```

--- Relative Order of Social Status:

```
[equal_higher(A,D),higher(C,B),higher(B,A)]
```

Further Solution? y.

no

| ?-

## • Dialogue 4

=====

a. Choi kwacang-i Chung cenmwu-kkey  
 chief-section-nom executive director-dat(hon)  
 selyu-lul tuli-ess-ni?  
 document-acc give(hum)-past-int  
 'Did chief-section Choi give a document to executive director  
 Chung?'  
 (Speaker: W, Addressee: J)

b. @ @ chengsacin-ul tuli-ess-eyo.  
 blueprint-acc give(hum)-past-dec(hon)

'He gave him a blueprint.'

(Speaker: J, Addressee: W)

```
=====
| ?- diag_mgr([[w,j,choi_kwacang_i,chung_cenmwu_kkey,selyu_lul,
 tuli_ess_ni],
 [j,w,e,e,chengsacin_ul,tuli_ess_eyo]]).
```

--- Dialogue Representation Structure:

```
[[msg1,msg2],
 [inquire(w,j,msg1(
 [A,B,C,D,E],
 [named(A,w),named(B,j),named(C,choi_chsc),
 named(D,chung_exdr),
 docu(E),main_pred(give_hm,C,D,E),
 equal_higher(A,C),higher(D,A),
 equal_higher(A,B)])),
 say(j,w,msg2(
 [F],
 [blpr(F),main_pred(give_hm,C,D,F),
 higher(D,B),equal_higher(D,A),equal_higher(B,C),
 not_equal(B,A)]))]]
```

--- Relative Order of Social Status:

```
[higher(D,A),higher(A,B),equal_higher(B,C)]
```

Further Solution? y.

no

| ?-

## • Dialogue 5

```
=====
a. R-kkeyse M-kkey choan-ul poyecwu_si_ess_e.
 nom(hon) dat(hon) draft-acc show-hon-past-dec
 'R showed a draft to M.'
 (Speaker: Youngsoo, Addressee: Sungmin)
```

```
b. Heesoo-ka M-ul manna-ss-ni?
 nom acc meet-past-int
 'Did Heesoo meet M?'
 (Speaker: Sungmin, Addressee: Youngsoo)
```

```
=====
| ?- diag_mgr([[youngsoo,sungmin,r_kkeyse,m_kkey,choan_ul,
 poyecwu_si_ess_e],
 [sungmin,youngsoo,heesoo_ka,m_ul,manna_ss_ni]]).
```

The 2nd utterance in dialogue is infelicitous since information about social status provided by the utterance is incompatible with that provided by its previous utterance(s).

no

| ?-

## • Dialogue 6

```
=====
a. Choi kwacang-i Chung cenmwu-kkey
 chief-section-nom executive director-dat(hon)
 selyu-lul tuli-ess-ni?
 document-acc give(hum)-past-int
 'Did chief-section Choi give a document to executive director
 Chung?'
 (Speaker: W, Addressee: J)

b. @ Han pwusacang-nim-kkey @ tuli-ess-eyo.
 vice president-hon-dat(hon) give(hum)-past-dec(hon)
 'He gave it to vice president Han.'
 (Speaker: J, Addressee: W)
=====
```

--- Dialogue Representation Structure:

```
[[msg1,msg2],
 [inquire(w,j,msg1(
 [A,B,C,D,E],
 [named(A,w),named(B,j),named(C,choi_chsc),
 named(D,chung_exdr),
 docu(E),main_pred(give_hm,C,D,E),
 equal_higher(A,C),higher(D,A),
 equal_higher(A,B)])),
 say(j,w,msg2(
 [F],
 [named(F,han_vpres),
 main_pred(give_hm,C,F,E),
 higher(F,B),equal_higher(F,A),equal_higher(B,C),
 not_equal(B,A)]))]]
```

--- Relative Order of Social Status:

```
[higher(D,A),higher(A,B),equal_higher(F,A),equal_higher(B,C)]
```

Further Solution? y.

```
no
| ?-
```

## • Dialogue 7

```
=====
a. Choi kwacang-i Chung cenmwu-kkey
 chief-section-nom executive director-dat(hon)
 selyu-lul tuli-ess-ni?
 document-acc give(hum)-past-int
 'Did chief-section Choi give a document to executive director
 Chung?'
 (Speaker: W, Addressee: J)

b. @ @ @ tuli-ess-eyo.
 give(hum)-past-dec(hon)
 'He gave it to him.'
 (Speaker: J, Addressee: W)
=====
```

```
| ?- diag_mgr([[w,j,choi_kwacang_i,chung_cenmwu_kkey,selyu_lul,
 tuli_ess_ni],
 [j,w,e,e,e,tuli_ess_eyo]]) .
```

--- Dialogue Representation Structure:

```
[[msg1,msg2],
 [inquire(w,j,msg1(
 [A,B,C,D,E],
 [named(A,w),named(B,j),named(C,choi_chsc),
 named(D,chung_exdr),
 docu(E),main_pred(give_hm,C,D,E),
 equal_higher(A,C),higher(D,A),
 equal_higher(A,B)])),
 say(j,w,msg2(
 [],
 [main_pred(give_hm,C,D,E),
 higher(D,B),equal_higher(D,A),equal_higher(B,C),
 not_equal(B,A)]))]]
```

--- Relative Order of Social Status:

```
[higher(D,A),higher(A,B),equal_higher(B,C)]
```

Further Solution? y.

```
no
| ?-
```

## • Dialogue 8

- ```
=====
a. Choi      kwacang-nim-i      Han      pwucang-nim-kkey
   chief section-hon-nom      department director-hon-dat(hon)
   chengsacin-ul      ponaytuli-si-ess-e.
   blueprint-acc      send(hum)-hon-past-dec
   'Chief section Choi sent a blueprint to department director Han.'
   (Speaker: Minho, Addressee: Sangchul)

b. Kang      kwacang-nim-i      Han      pwucang-nim-ul
   chief section-hon-nom      department director-hon-acc
   poy-si-ess-e.
   meet-hon-past-dec
   'Chief section Kang met department director Han.'
   (Speaker: Sangchul, Addressee: Minho)

c. ☉ Choi      kwacang-nim-eykey      choan-ul      poyecwu-si-ess-e.
   chief section-hon-dat      draft-acc      show-hon-past-dec
   '☉ showed a draft to chief section Choi.'
   (Speaker: Minho, Addressee: Sangchul)

d. ku-ka      chengsacin-ul      kuli-ess-ni?
   he-nom      blueprint-acc      draw-past-int
   'Did he draw the blueprint?'
   (Speaker: chief section Kang, Addressee: Minho)
=====
```

```
| ?- diag_mgr([[minho,sangchul,choi_kwacang_nim_i,
               han_pwucang_nim_kkey,chengsacin_ul,
```

```

ponaytuli_si_ess_e],
[sangchul,minho,kang_kwacang_nim_i,
han_pwucang_nim_ul,poy_si_ess_e],
[minho,sangchul,e,choi_kwacang_nim_eykey,
choan_ul,poyecwu_si_ess_e],
[kang_kwacang,minho,ku_ka,chengsacin_ul,
kuli_ess_ni]]).

```

--- Dialogue Representation Structure:

```

[ [msg1,msg2,msg3,msg4],
  [say(mh,sc,msg1(
    [A,B,C,D,E],
    [named(A,mh),named(B,sc),named(C,choi_chsc),
     named(D,han_dpdr),
     blpr(E),main_pred(send_hm,C,D,E),
     higher(C,A),higher(D,C),equal_higher(A,B)])),
   say(sc,mh,msg2(
    [F],
    [named(F,kang_chsc),
     main_pred(meet_hm,F,D),
     higher(F,B),higher(D,F),equal_higher(B,A)])),
   say(mh,sc,msg3(
    [G],
    [drft(G),main_pred(show_nh,F,C,G),
     higher(C,A),equal_higher(F,C),
     equal_higher(A,B)])),
   inquire(kang_chsc,mh,msg4(
    [],
    [main_pred(draw,C,E),
     equal_higher(F,C),equal_higher(F,A)])))] ]

```

--- Relative Order of Social Status:

```
[higher(C,A),equal(A,B),higher(D,F),equal_higher(F,C)]
```

Further Solution? y.

no
| ?-

• Dialogue 9

- ```

=====
a. Choi kwacang-nim-i Han pwucang-nim-kkey
 chief section-hon-nom department director-hon-dat(hon)
 chengsacin-ul ponaytuli-si-ess-e.
 blueprint-acc send(hum)-hon-past-dec
 'Chief section Choi sent a blueprint to department director Han.'
 (Speaker: Minho, Addressee: Sangchul)

b. Kang kwacang-nim-i Han pwucang-nim-ul
 chief section-hon-nom department director-hon-acc
 poy-si-ess-e.
 meet-hon-past-dec
 'Chief section Kang met department director Han.'
 (Speaker: Sangchul, Addressee: Minho)

```

c. @ Choi kwacang-nim-eykey choan-ul poyecwu-si-ess-e.  
 chief section-hon-dat draft-acc show-hon-past-dec  
 'He showed a draft to chief section Choi.'  
 (Speaker: Minho, Addressee: Sangchul)

d. kupwun-kkeyse chengsacin-ul kuli-si-ess-ni?  
 he/she (hon)-nom(hon) blueprint-acc draw-hon-past-int  
 'Did he/she draw the blueprint?'  
 (Speaker: chief section Kang, Addressee: Minho)

=====

```
| ?- diag_mgr([[minho,sangchul,choi_kwacang_nim_i,
 han_pwucang_nim_kkey,chengsacin_ul,
 ponaytuli_si_ess_e],
 [sangchul,minho,kang_kwacang_nim_i,
 han_pwucang_nim_ul,poy_si_ess_e],
 [minho,sangchul,e,choi_kwacang_nim_eykey,
 choan_ul,poyecwu_si_ess_e],
 [kang_kwacang,minho,kupwun_kkeyse,
 chengsacin_ul,kuli_si_ess_ni]]).
```

--- Dialogue Representation Structure:

```
[[msg1,msg2,msg3,msg4],
 [say(mh,sc,msg1(
 [A,B,C,D,E],
 [named(A,mh),named(B,sc),named(C,choi_chsc),
 named(D,han_dpdr),
 blpr(E),main_pred(send_hm,C,D,E),
 higher(C,A),higher(D,C),equal_higher(A,B)])),
 say(sc,mh,msg2(
 [F],
 [named(F,kang_chsc),
 main_pred(meet_hm,F,D),
 higher(F,B),higher(D,F),equal_higher(B,A)])),
 say(mh,sc,msg3(
 [G],
 [drft(G),main_pred(show_nh,F,C,G),
 higher(C,A),equal_higher(F,C),
 equal_higher(A,B)])),
 inquire(kang_chsc,mh,msg4(
 [],
 [main_pred(draw,D,E),
 higher(D,F),equal_higher(F,A)]))]]]
```

--- Relative Order of Social Status:

```
[higher(C,A),equal(A,B),higher(D,F),equal_higher(F,C)]
```

Further Solution? y.

no  
 | ?-